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METAL FINISHING

MAY, 1954 VOLUME 52 • NUMBER 5

DEPARTMENTS

COMING SOON

The complete program for the 41st annual convention of the American Electroplaters' Society, to be held in New York in July, will appear in our June issue.

A report of the papers presented at the fourth International Conference, held in London, will also appear in the June issue.

An attempt at summarizing, in reasonably simple form, the present state of knowledge of the structure of electrodeposits.

The history and development of plating in the automotive industry.

Electroplating on zirconium differs from the methods for plating on other metals. The general procedure used is discussed in this article.

SUBSCRIPTION INFORMATION

United States and Canada $4.00 per year, other countries $8.00. Single copies 45c in United States and Canada, other countries 85c. GUIDEBOOK-DIRECTORY 22nd edition 1954 current, 570 pages 5¼ x 7⅞ $3.00. A copy of this book is included with subscriptions. Please remit by check or money order; cash should be registered. Request for change of address should reach us on or before the 15th of the month preceding the issue with which it is to go in effect. In sending us your change of address, please be sure to send your old address as well as the new one. It is difficult and often impossible to supply back numbers. Re-entered as second class matter June 13, 1940 at the post office at New York, N. Y. under the Act of March 3, 1879.

MAY 1954

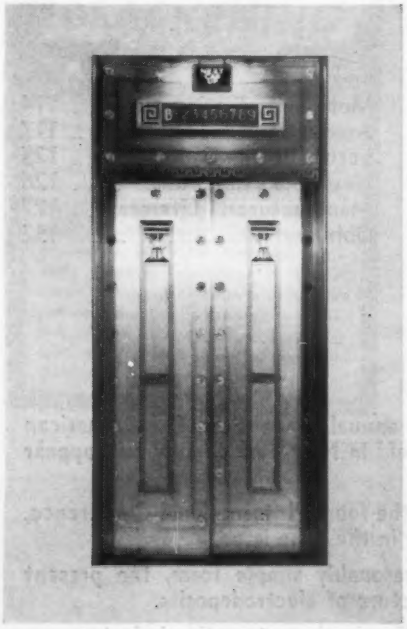
LEA SATIN FINISH—"The Finish of Quality"

- **Satin Finished Articles have that quality look and retain this appearance for a long time because the finish is not easily marred.**
- **The economy of the Satin effect is well known. The Satin Finish blends with and eliminates the effect of underlying metal imperfections. As a result one or more finishing operations become unnecessary, thereby cutting production costs.**
- **Satin Finished products are finding more and more consumer acceptance everyday**

Here are some case histories showing how the Lea Method of Satin Finishing has helped cut production costs.

ALUMINUM

Material — Aluminum.
Article — Furniture trim.
Method of Forming — Punching and stamping.
Final Finish — Satin.



Lea Method:
1. 120 set-up wheel.
2. Lea Compound Grade "L" or "C" on 10" diameter loose muslin buff at 1500 r.p.m.
3. Anodize.

Remarks —
Previously this work had been done by the use of Tripoli buffing after the polishing wheel operation, resulting in some polishing marks remaining. This step involved excessive cleaning which was entirely eliminated by the Lea Method.

BRASS

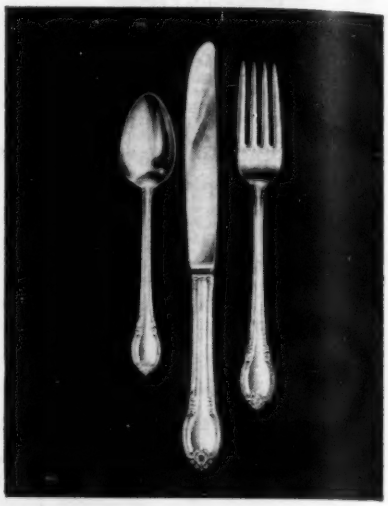
Material — Brass.
Article — Heavy Door Pulls.
Method of Forming — Casting & machining.
Final Finish — Satin finish.
Lea Method:
1. 100 set-up wheel (canvas).
2. 120 set-up wheel (felt).
3. Grade "B" Lea Compound on a 10" diameter muslin buff with radial sewing at 1800 r.p.m.
4. Lacquering.

Remarks —
The Lea Compound step was done in the same direction as the last polishing wheel operation so that there was no crossing of lines. The finish desired was produced with a minimum number of wheel operations and all cleaning eliminated.

STEEL

Material — Steel.
Article — Escutcheon plates, door plates, etc.
Method of Forming — Stamped.
Final Finish — Special satin brass plate.
Lea Method:
1. Brass plate.
2. Lea Compound Grade "R" on a 10" loose buff at 1500 r.p.m.
3. Lacquering.

Remarks —
In substituting for wet scratch brushing, the Lea Method eliminates all cleaning and drying and the nuisance of water stains on the brass surface.



SILVER

Material — Silverplate.
Article — Tableware.
Method of Forming—Forging (nickel silver).
Final Finish — Butler Finish.*
Lea Method:
1. Silver plate.
2. Lea Compound Grade "FG," "MF," or "MH" on 6" brass wire wheel at 800 r.p.m.

Remarks —
Fine grades of Lea Compound on a brass wire wheel produced the bright line finish required without the aid of a prior color buffing operation common to the old wet scratch brushing procedure.

*Butler Finish — A fine delicate satin finish with some brilliance.

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Why Attend AES Conventions?

This question comes at a time when loyal members of the *American Electroplaters' Society* and others close to AES, already are making plans to attend the annual Society Convention in New York City this July. It comes at a time, too, when some may be questioning whether the expense of going to an AES convention is justifiable. It is mostly to the latter group that these remarks are directed as well as to employers who are attempting to justify their convention experience as a legitimate company expense item for an employee who may desire to attend.

As one who has been imbued with the AES spirit through two generations of AES membership, I have been exposed repeatedly to the atmosphere of AES conventions. I feel somewhat qualified, therefore, to pass on some observations in answer to the question.

(1) Information obtained and exchanged in face-to-face contacts in Educational Sessions and at informal get-togethers is worth greater take-home payoff than is represented in the official fare. Further, actually attending and taking part in a convention is certainly more advantageous than just reading a paper which has been presented at a convention.

(2) Fellow members, non-members and their families from all parts of the world come to share the camaraderie and conviviality that an AES convention offers not only through its educational and business sessions, but also through a program of fun and entertainment.

(3) New friendships are made and old ones are renewed. It is not uncommon after one or two conventions to come away with at least a dozen or more first-name friends upon whom you can rely when you need assistance. AES convention contacts on many occasions have eventuated in new accounts and in cementing relationships with old ones.

(4) Another reason is the opportunity to see and learn first-hand how the AES functions. Important decisions are made which may influence the future of the Society and the plating industry as a whole.

There are many other reasons, of course . . . how, for example, many major changes of practice in plants and shops have taken place years sooner than would have otherwise as a result of information picked up in a conversation or from a convention meeting.

In summary, dollar-for-dollar, and for value received, you cannot afford to miss an AES convention. As one who knows the advantages, I say it is an investment . . . an investment in the future of the plating and finishing industries.

GEORGE SCHORE,
AES Convention Chairman, 1954

Stop-offs in Hard Chrome Plating

By Arthur W. Logozzo, *President, The Nutmeg Chrome Corp., West Hartford, Conn.*

ONE of the basic differences between success and failure of a hard chrome plating job is the stop-off method used. When selective areas of a given part are to be plated either for functional reasons or salvage purposes then the stopping-off of areas not to be plated is of prime importance.

The selection of stop-offs revolves around the design of the part and its function. Where sharp edges are involved, one type of material is used. Where no sharp edges are concerned, then other materials can be selected. After studying and working at hard chrome plating for well over twenty years the author has set up a few simple basic rules.

One of the first considerations in stopping-off is the fact the piece should remain undisturbed on the areas not requiring plating, and the areas being plated should be as bright and smooth as possible and free of nodules on sharp edges. The philosophy of many hard chrome platers is to get the stock on the part and not worry about appearance because the piece is going to be ground anyway. This thinking is not conducive to good hard chromium promotion and should be corrected immediately. In the first place, a rough nodular edge is not a homogeneous chrome deposit but is powdery and brittle. The physical characteristics of a hard, bright, and smooth deposit should always concern hard chromium platers and be uppermost in their minds when planning a stop-off and a mechanical setup. Secondly, assuming this deposit is to be ground, the plater should always consider the subsequent operation — grinding. The grinder not only tears wheels mercilessly on rough deposits but he has no alternative except to leave a checked, cracked deposit with little or no value when considering stress and fatigue factors.

Figure 1.

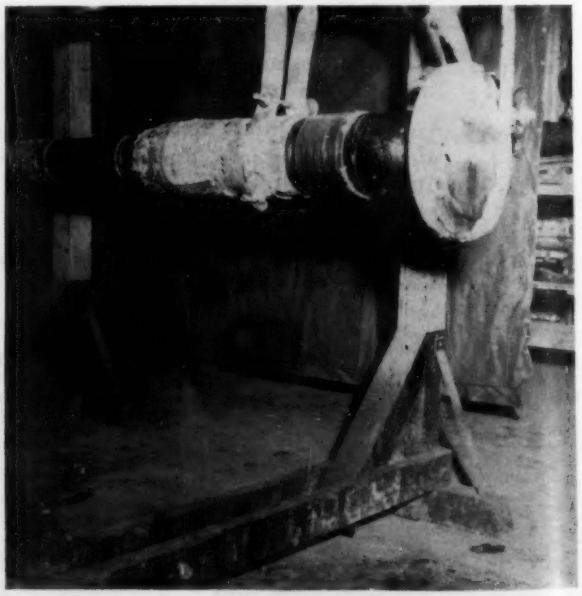


Figure 2.

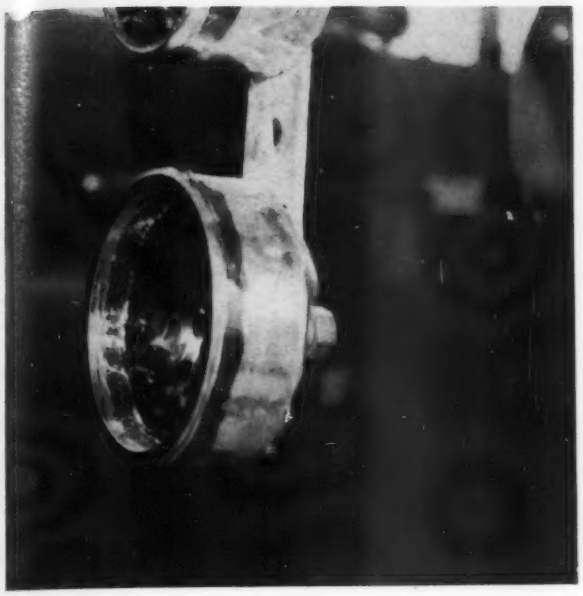


Figure 3.

Figure 4.

Where no grinding is to be done after plating and lighter deposits are the order of the day, then it becomes even more important to use stop-off methods that will guarantee even deposits. This will facilitate subsequent polishing, which is also essential. Usually, lighter deposits of chrome are applied to reduce friction in a functional part, and rough edges or nodules of any description do not belong in this scheme.

Tools

As for any successful operation, good tools are a must. One needs a set of sharp knives for trimming the various stop-offs; good scissors; pliers for cutting wire and wrapping it around parts holding various metallic materials; pliers with sharp cutting edges; pliers with good jaws; hammers and mallets; good ball peen hammers; lead, leather and plastic mallets for pounding materials into holes, breaking lead, etc. at sharp edges without damaging the parts. (See Fig. #1.)

One needs a good assortment of brushes for the many lacquering jobs. The experienced hard chrome stop-off expert makes an artist look like a novice when it comes to wielding a brush. He must be able to work into all sorts of tight corners, deep crevices, etc. and many times a job requiring buildups of chrome in hard to get at areas is a failure because of inadequate lacquering.

Lead Foil

The types of stop-off materials include sheet lead, sheet aluminum, lacquers, plastics of all description, lead backed tapes, vinyl tapes, Scotch tapes, waxes, etc. and the illustrations that follow will try to point out appropriate spots for most of them.

Figure 5.

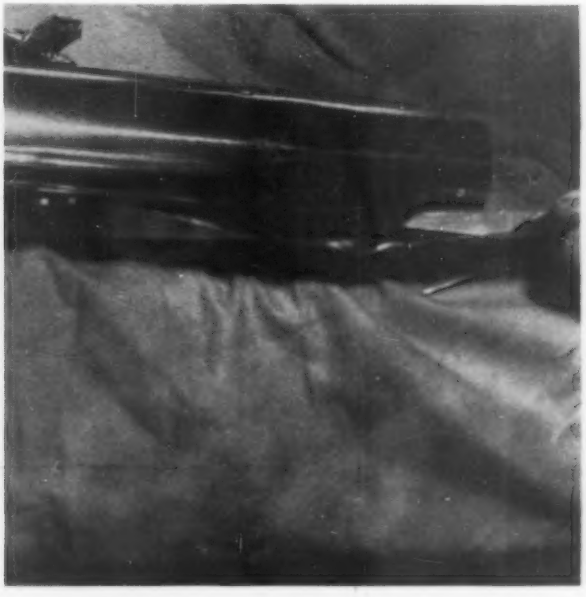


Figure 6.

Figure 7.

Figure 8.

The first and most important stop-off material is lead. Foil .004" thick and foil .010" thick are most common. This material is used for a positive stop-off, gives good conductivity through various clamping methods used on fixtures, etc. and is used to control buildup at edges. The lead, when trimmed sharply at an edge, absorbs the excess of chrome and prevents this highly undesirable buildup. The photo of a large shaft (Fig. #2) illustrates lead stop-off, and the heavy build-up is clearly shown to have deposited on the lead edge and not the shaft journal edges. Lead, being pliable, can be worked over any type of an edge or contour and then by pushing a soft tool against it will clearly define the area to be trimmed with a knife. After the trimming operation lacquer can be utilized for proper insulation and current distribution.

Figure #3 shows a part masked in lead and exposing the extreme front edge only. It was imperative that this part have a smooth deposit of several thousandths chrome and maintain sharp edges. The photo illustrates the clean sharp trim of the lead and shows the lacquer lines outside and also inside. In both cases there is approximately ¼" lead exposed for complete edge protection from buildup and the lacquer eliminates the possibility of the lead robbing too much and also precludes the possibility of the plating electrical phenomena — reversing polarity and producing a non-uniform plate and possible bare spots.

Figure #4 illustrates the use of lead foil on a mold. The ground sections that have already been fitted to a shoe are given a positive stop-off in this manner. Note the lead being wired into position and then trimmed at the upper edge.

After lead has been used for stop-off purposes it can

Figure 9.

Figure 10.

Figure 11.

Figure 12.

be sold for scrap so that it is far from a total loss. Figure #5 shows two rolls of lead foil, the .004″ thick and the .010″ thick, which is recommended for each hard chrome plater's bench for ease of operation and handling. Figure #6 demonstrates the ease of cutting with ordinary scissors.

Figure #7 is a photo of two pieces that come in lots of 200 pieces to be plated .006″ thick on the flat surface with the single hole. The small piece in front of the two parts is a lead plug made from ¼″ wire. That is used to stop-off the hole. After plating this plug is knocked out from the back side and can then be reused in a subsequent lot. In Figure #8 we show these parts being fastened to a copper strap with a $\frac{1}{16}$″ thick lead shield. Figure #9 shows the lead shield in place. This is what we call group stopping off. The parts protect each other by being set next to one another as illustrated in Figures #8 and #9. Fixtures for group stopping-off are built whenever there is to be repeat business and this then permits a semi-production run even though they are selectively built up.

Plastic Sheet

Plastic in many forms is also utilized for stopping-off. Materials like polyethylene, polystyrene, methyl methacrylate, vinyls, etc. have helped ease the stop-off burden. These materials are non-corrosive, non-conductive, flexible, and in many cases reusable. Figure #10 is an example of a fixture using sheet vinyl as a stop-off for the back section of parts that called for .002″ of plate on the top face, bevel and edge. A vinyl washer is fastened to the center, acting both as a stop-off and also to hold the part to the contact strap behind the sheet plastic.

A polyethylene sheeting, as shown in Figure #11, is

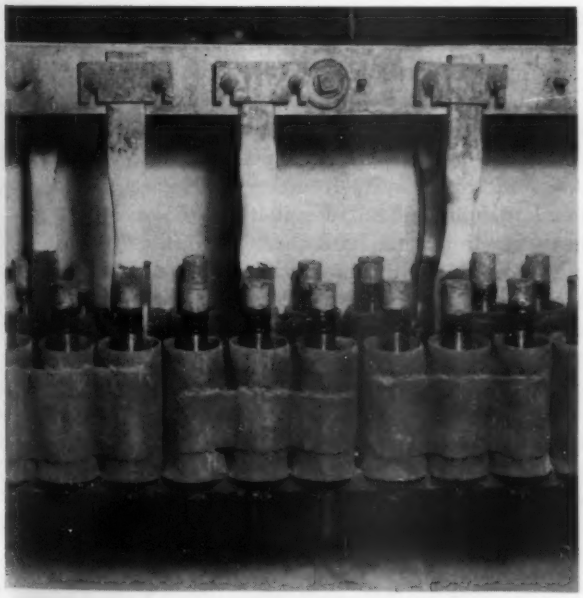


Figure 13.

Figure 14.

a most useful item to have around. It is a timesaver where large parts, calling for a small area to be hard chromed, must of necessity have the rest of the object stopped-off. Figure #12 is a good illustration of this showing one shaft already covered and the others ready for the .004" thick polyethylene sheeting. After the plating operation the sheeting is washed and hung up to dry for reuse. Also note the use of lead foil, vinyl tape and lacquer, all essential because of the long period of time in the plating bath. Figure #13 is another example of the use of combinations of stop-off materials. On this job the caps were used over many times.

Tapes

The use of tapes of various descriptions and compositions is finding its way into the hard chrome shop more all the time. In Figure #14 we have an adhesive backed lead and aluminum tape with a roll of vinyl. The aluminum has not found many uses. The lead tape works out fairly well when masking parts that do not require too long a run in the chrome tank. Unfortunately, the adhesive does not stand up for more than a few hours. For any light runs it can be depended upon.

One note of caution on the lead backed tape on light runs is its use next to sharp cut-off edges. Unfortunately, the organic adhesive has the same effect as a coat of lacquer next to a sharp edge, which means a buildup or edge distortion. The adhesive has a tendency to leave a saw-tooth effect when so employed on these important edges. We find it preferable always to use plain foil properly trimmed at these edges, even though the temptation to use the easier-to-apply tape is very strong.

Vinyl tape is used wherever a good solid film of dielectric protection is demanded. It is also used to tie anodes into a fixed position in hard-to-get-at places. It is excellent next to anodes on lengthy runs, eliminating short circuits between anode and cathode. It also helps for quick, positive stopping-off of fixtures.

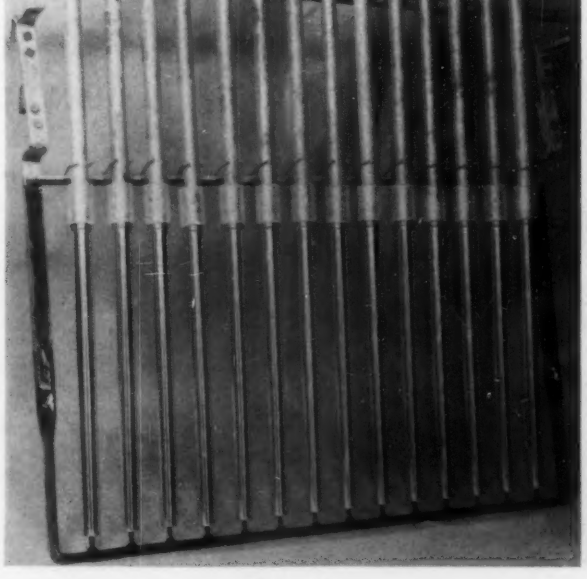


Figure 15.

Figure 16.

Other Types

Figure #15 is a good illustration of tubular plastic use in stopoff. This is a tube that required nickel and chrome (a departure from the usual hard chrome job, but nevertheless necessary) on the lower end and absolutely no plate above the center ring. Individual wrapping or lacquering would have been prohibitive, both putting it on and taking it off. We tried these tubes which fit loosely enough to permit free rinsing but not too loose to allow plating. The solution levels were half way up the plastic tube and the job worked like a charm with no additional charge needed for the stop-off.

On many jobs where no particular edges have to be of major concern then we use lacquer. Figure #16 illustrates a part with a hole in it that is being lacquered for a chrome plate of .0005". If a heavier deposit were required then we would plug the hole with lead.

If the reader is wondering about the absence of wax in our stopping-off operations it is merely because our type of work lends itself to the stop-offs previously mentioned herein. Many people find the newer nontoxic waxes very useful, however, and our only comment on its use is the usual precautions for any organic; be careful next to edges. Wax also has a tendency to shrink away from vertical sections adjacent to a horizontal one but, despite these shortcomings, still has a function in the hard chrome shop.

The work a hard chrome shop has to contend with is usually fairly expensive. This means care has to be exercised in its handling. Unfortunately, highly lapped or finished parts have a tendency to stain or develop oxides after long runs in the bath under various stop-off materials. One simple recommendation under these conditions is to put on a light chrome plate, two or three minutes, before stopping-off and setting up. This will eliminate any surface condition reactions and save much grief. After buildup is completed the light film of plate can be stripped without affecting the heavy deposit. This then insures a good clean surface back to the customer.

Government Finishing Specifications

An Explanation and Digest Relating to Metal Coatings and Surface Treatments* (Other than Organic Coatings)

By N. E. Promisel, *Navy Department Bureau of Aeronautics and* David M. Promisel

Mr. Promisel joined the Navy Department during World War II, after his previous activities at the International Silver Co. and in private consulting practice. Although not as active in the electroplating field as in earlier years, this subject still remains one of his major interests. He is currently Chief Metallurgist and Head of the Materials Branch of the Bureau of Aeronautics, in charge of research, development, specification control and other aspects covering the materials, processes and treatments used in the construction of aircraft, missiles, etc. His son, David M. Promisel, who assisted substantially in abstracting the specifications, is a student at Johns Hopkins University.

SPECIFICATIONS, whether prepared by the Government or by industry, by their very nature and purpose tend to become a target of criticism by the vendor — at least until he becomes the purchaser. Undoubtedly, criticism is many times justified, for it is no simple task to describe accurately and unambiguously — and, of course, preferably quantitatively — the attributes of a product precisely necessary to serve its given function, particularly when the vendor often has only a hazy notion of just how the product is to be used and why certain detailed requirements are what they are. It is not difficult to comprehend, therefore, that the U. S. Government, as the biggest procuring agency in the world, circumscribed with restrictions, considerations and sensitive specialties wholly inapplicable to even the biggest industrial organization, has unique and complex specification problems. In the interest of a broader basic understanding of Government specifications, it may be worth pausing a moment before becoming engaged with specific abstracts of specifications, to consider some of the tenets and factors pertinent to the Government specification system.

Government specifications are written to serve as a basis for unbiased procurement, to describe a product so completely that all who are in a position and desire to do so may bid on an equal basis, and to protect legally the best interests of the Government (that is, the taxpayer). The specification for any particular product must insofar as possible cover all contingencies, anticipate all questions, apply to all sources and be completely adequate without supplementary discussion in describing the product. The Government cannot, as can industry, pick up the telephone, call a favored steel company and make private and special arrangements for a shipment of steel! The Government must in a broad sense, be mute; the specification must speak for itself to all who desire to listen. This is one of the primary reasons for the often elaborate inclusion in Government specifications of both detailed and general requirements and inspection and acceptance standards, where some industry specifications may be briefer, but "subject to agreement between vendor and purchaser."

But why more than one specification, at times, for what *appears* to be the same product? The answer is simple. The requirements for a particular steel in an airplane, where margins of safety are shaved to the barest minimum and a failure so often means no second chance to correct the error, can quite evidently be appreciably different from the requirements for the same *kind* of steel going into a truck or into a ground installation. So the Air Force and the Navy Bureau of Aeronautics may have specifications on "aircraft quality" steels and other Government agencies may have agreed on "Federal" specifications, not quite so stringent, for the same nominal steel compositions but not necessarily of the same superior quality.

This brings us to the subject of different types of specifications. Much effort has been devoted to standardization of specifications and much progress in reality has been achieved. From the above discussion alone, however, it is evident that there can never be a truly "single" series of specifications, except in format and nomenclature. To achieve such a single one-specification-per-product series or system would necessitate either compromising quality beyond a degree where the product is satisfactory for all intended purposes or, alternatively, to upgrade the quality to the highest level, in which case it would be unnecessarily good (and expensive!) for the less severe applications! However, insofar as possible, requirements for a given

*The expressions and opinions in this article are those of the authors and not necessarily those of the Department of Defense.

product are made identical and combined with the necessary variations into a single specification or into a minimum number of specifications, and also coordinated with industry. Also, in general, standard commercial products are specified so that the disadvantage of there being more than one specification is minimized.

Here are the various major types of Government specifications at the present time; some are rapidly becoming discontinued, as noted below:

Major Types of Specifications

FEDERAL SPECIFICATIONS:

These have the broadest coverage for the most general usage, represent the widest coordination and are used by the greatest number of Government agencies. When they are suitable for given applications, they are preferred to all others. They are issued by the Bureau of Federal Supply and prepared under the supervision of the Government activity most directly concerned with and best qualified technically to handle the specific item covered. Copies are available from the Superintendent of Documents, Government Printing Office, Washington 25, D. C. at very nominal prices. The members of these specifications have the basic form XX-Y-000, where the first part (a group of letters or single letter) denotes a type of product; the second part (a single letter) is the first letter in the specification title; and the third part (a number of one or more digits) indicates the serial number in that class. A small letter following the number indicates a revision. Thus QQ-P-416 indicates a metal specification (QQ), Plating, Cadmium (P), number 416 in the QQ-P-series. The first revision of this specification, soon to appear, will have the number QQ-P-416a.

MILITARY (MIL) AND NATIONAL MILITARY ESTABLISHMENT (JAN) SPECIFICATIONS:

These specifications form the second "broadest coverage," most widely coordinated, Government specifications. They are issued by the Office of Standardization of the Department of Defense and are developed jointly by technical groups of the Army, Navy and Air Force, with one of these acting as preparing "Custodian." The "JAN" series was initiated prior to the formation of the Department of Defense (unification of the separate Departments of the Army, Navy and Air Force and are now being superseded by the "MIL" series. The latter has the basic form of number MIL-Y-0000. The MIL obviously stands for "Military." The second part (single letter), as in the case of the Federal specifications described above, indicates the first letter of the title and the third part (a number) indicates the serial number in that category. Again, small letters following the number indicate revisions. An abbreviation in parenthesis following the number indicates this is as yet an uncoordinated specification used exclusively or primarily by the agency represented by the abbreviation, which is also the agency which prepared and issued the specification. Thus MIL-C-15205 (SHIPS) represents a specification for "Compound, Metal-Conditioning," prepared and issued by the Navy Bureau of Ships, used primarily by that agency and not yet coordinated with other groups of the Department of Defense. The JAN series follows the same number pattern, substituting "JAN" for "MIL". Some "MIL" and "JAN" specifications require previous qualification or an approval; i.e., testing and approval of the material or product in accordance with the requirements of the applicable specification prior to contract placement. These approved materials and products are then listed in a Qualified Products List (QPL) bearing the same serial number as the specification.

AIR FORCE-NAVY AERONAUTICAL SPECIFICATIONS:

This is the next series in order of widest coordination and represents specifications used primarily by the Air Force and the Navy Bureau of Aeronautics. These are being replaced by "MIL" specifications gradually, and as such, when they apply particularly to aircraft, they bear the standard MIL number followed by (ASG), the latter indicating the Aeronautical Standards Group, which coordinates and arranges for issuance of these specifications. The specifications are prepared by either the Air Force or the Navy Bureau of Aeronautics and follow the general pattern of MIL specifications described above, including Qualified Product Lists. The specification numbers have the form AN-Y-00, where AN stands for Air Force-Navy, Y stands for the first letter in the title, and 00 is the serial number. Revisions are indicated by a small letter after the number, and amendments are indicated by a dash number.

Air Force-Navy Aeronautical Bulletins (ANA-000) also exist, numbered beginning with 100, and are issued for informational purposes or to list products which have passed the qualification tests of Air Force-Navy Aeronautical specifications.

DEPARTMENTAL SPECIFICATIONS:

These are specifications prepared and issued by either the Department of the Army, Navy or Air Force to meet special requirements of that department. They are being generally superseded by "MIL" type specifications. Some of these departmental specification forms are:

Army: A two part number system such as U.S.A. 72-53, "Finishes (For Ground Signal Equipment)."

Navy: A three part number-letter-number system such as 46Z3, "Zinc-Coating (Hot-Dip Galvanizing)."

Air Force: A number system such as 14126, "Compound Plater's Electrocleaning."

MISCELLANEOUS SPECIFICATIONS:

There exists some additional Government specifications, of limited and specialized application, which space does not permit discussing in detail. These apply to the peculiar needs of individual bureaus of the Navy, such as Bureau of Aeronautics and Bureau of Ordnance specifications, and individual groups in the Army, such as Ordnance and Arsenal specifications. For the most part, these also are being replaced by a type of "MIL" specification.

Basic Factors

It is important to recognize and understand several basic aspects related to Government specifications:

a) *Only the contracting agency (or its designated*

agent) can establish which specification it will use. If a Federal specification exists and is suitable for that agency's particular needs, the agency will use that Federal specification. If such a specification does not exist, it may use a specification issued by another agency or another department, if suitable. Failing this, it may issue its own specification. Because of the complexity and importance of the technical decisions, therefore, there is no single, centralized source in an all-knowing position to furnish information on specifications used by all Government agencies. Only the agency which will use the product can state its choice with finality.

b) Although a number of indices of specifications exist, for reasons given above and because revisions and amendments frequently exist, the only safe specification to follow is the one called out specifically in a contract, order, drawing or applicable document.

c) Questions relating to specifications on a contract should always be addressed to the contracting agency, generally via the applicable Government inspector or representative, if one exists. Such inquiries should *not* be addressed to the author of this article. In the case of sub-contracts, questions should be addressed, in general, *to the prime contractor*, unless otherwise directed.

d) There are no short-cuts to complying with a specification. It is only common sense for bidders and contractors to be thoroughly familiar with applicable specifications, drawings and similar documents.

In the brief summaries of the specifications which follow, the main objective is merely to acquaint the reader with the nature of the specification. The summaries will generally touch only the high-lights; space limitations dictate omission of some important but lengthy or complex details. *In no sense should any summary be construed as a substitute for the specification itself.* Only the specification, (specific by number, date, revision and/or amendment) relating to the contract is authoritative. No attempt has been made to check, interpret, coordinate or otherwise supplement the statements contained in any of the specifications abstracted herein.

Although every effort has been made to present a complete and up-to-date list of specifications pertaining to metal surface treatment and coating (exclusive of organic coatings), the word "complete" is relative, and arbitrary decisions have been necessary in selecting or omitting a number of finishing specifications related only incidentally to this subject. In addition, particular and specific finishing requirements are often included in individual specifications for equipment or end-items, such as in specifications for hardware, instruments, machinery and other metal products. In such cases, the specific finishing requirements take precedence over the more general requirements of the specifications listed herein, when conflict between them exists. Several specifications relating to test methods in various environments have been included, with very brief abstracts, since the reader may frequently encounter references to these specifications in practice.

METALLIC COATINGS

Military Specification MIL-P-6859, 7 August 1950

Plating, Nickel

(Supersedes AN-P-34a and is identical to AN-P-34a, Amendment -1, dated 4 May 1948)

TYPES AND CLASSES:

Type I—Thin deposits (decorative)
Class A —Matte Finish
Class B—Bright Finish

Type II—Heavy deposits (mechanical application or for severe corrosive conditions)
Class C—Plated to dimensions
Class D—Machined or ground to dimensions.

THICKNESS:

Type I, Classes A and B: 0.001 inch, minimum, on ferrous material. 0.0005 inch, minimum, on non-ferrous material.

Type II, Classes C and D: 0.003 inch, minimum. For Class D deposits, this thickness applies after all machinery or grinding operations have been completed.

May be determined by microscope method, magnetic method, micrometer, stripping or dropping tests.

ADHESION:

When examined at a magnification of 4 diameters, plating shall show no separation from basis metal when specimen is bent through 180 degrees on a diameter equal to the thickness of the specimen and then straightened.

HYDROGEN EMBRITTLEMENT RELIEF:

All parts having hardness greater than Rockwell C-40 shall be baked 375°F. ± 25°F. for 3 hours.

SALT SPRAY ("STANDARD 20%" SOLUTION)

Shall show no appreciable corrosion when exposed for following periods:

Type I, Classes A and B: 48 hours.

Type II, Classes C and D: As specified for individual part.

Military Specification MIL-P-20218 29 October 1951

(Supersedes Navy Department Specification 46P3 (INT) dated 1 November 1945)

Plating, Chromium, Electro-deposited, Porous

(On Cylinder Bores of Internal Combustion Engines)

Covers porous chrome plating on cylinder bores of internal combustion engines, consisting of two types.

TYPES:

I Channel
II Pin-point

Plating Process approval: Required.

REQUIREMENTS:

Thickness: Not less than 0.005 inch radial, after final honing.

Porosity: "*Average*" 20 to 50% over the area swept

by the piston rings, after final finishing. Lines shall be examined at 50 diameters magnification and compared with photomicrographic standards included in specification.

Surface Imperfections: Pits or unplated areas up to ¼ inch diameter are acceptable under certain prescribed conditions.

Cleaning: Required, after finishing to size, to remove all loose material from surface voids.

Channel and Pin-Point Types shall conform to photomicrographic standards included in specification.

Military Specification MIL-T-10727 (Ord), 28 November 1950

Tin Plating: Ferrous and Non-Ferrous Metals

Covers requirements for tin plating ferrous and non-ferrous metals.

TYPES:

I Electrodeposited
II Hot-dipped

REQUIREMENTS:

Base Metal shall be clean, stain free, pickled for 2-5 minutes in cold 15% (vol.) sulphuric acid and 2% (vol.) nitric acid and dipped in flux solution composed of 3 lbs. zinc chloride and 0.3 lbs. ammonium chloride per gal. water. Stains on copper or brass alloys shall be removed by dip in acid or warm cyanide.

Minimum thickness — As specified in drawing, contract or order. To measure thickness may use microscope, magnetic method, chord method or calculation based on loss in weight after stripping. Stripping from ferrous metals shall be in a solution of 12 ozs. Hydrochloric acid and 2 ozs. antimony trioxide per gal. of water; from non-ferrous, solution shall be 10-14 ozs./gal. ferric chloride, 18-21 ozs./gal. copper sulfate and 40-60 fl. ozs./gal. acetic acid.

Adhesion — Coating shall not show separation from base metal when specimen is bent 180 degrees on a diameter equal to its thickness, when examined at four diameters magnification.

Soldering — When item is to be soldered later, the coating, after fluxing with non-corrosive flux, shall be easily tinned when dipped for 3 seconds in a 40% tin - 60% lead solder at 550°-660°F.

Coating — All tin plated parts to be used as terminals, chassis, etc., and to be soldered shall be dipped into or coated with 1 oz. stearic acid dissolved in 1 gal. xylol., used at room temperature.

Salt Spray — After 24 hours in "standard 20%" salt spray, coating shall show, to the unaided eye, no white salts through scratches nor more than six corroded areas per sq. ft. nor any corroded area larger than $\frac{1}{16}$" in diameter.

Guides. The following thicknesses are suggested for guidance only:

0.0001" for "tin flashing" of articles to be soldered.
0.0002-0.0004" for articles to prevent galling or seizing.
0.0002-0.00025" for articles generally plated to prevent corrosion of base metals.
0.0002-0.0006" for articles to prevent formation of case during nitriding.

Federal Specification QQ-Z-325, 21 January 1952

Zinc Plating (Electrodeposited)

CLASSES AND THICKNESS:

Class 1: 0.0010 in. thick, average minimum[1]
Class 2: 0.0005 in. thick, average minimum[1]
Class 3: 0.00020 in. thick, average minimum[1]

Note [1] — No single minimum value shall be less than 70% of this value.

TYPES:

Type I: Without supplementary chromate or phosphate treatment.

Type II: With supplementary chemical or electrochemical chromate treatment primary purpose of which is to retard or prevent white corrosion products. Some chromate coatings have been satisfactory as a paint base.

Type III: With supplementary chemical phosphate treatment, primary purpose of which is to form a paint base.

GENERAL:

In general, undercoatings shall not be used.

In general, a light or dull finish is acceptable.

Parts with hardness greater than Rockwell C-40 shall be stress-relieved before cleaning and plating if they contain objectionable residual stress.

Springs or other parts subject to flexure or repeated impact and with hardness greater than Rockwell C-40 shall be baked after plating, and prior to any flexing or supplementary treatment, at 375° ± 25°F. for 3 hours. Parts previously heat treated below 375° shall receive an approved baking. Anodes or baths containing mercury shall not be used.

DETAIL REQUIREMENTS:

Salt-spray — ("standard 20%" solution) — Type II shall show no white corrosion products after 96 hours exposure.

When specified, Types I and III shall show no corrosion products of the basis metal after 192 hours and 36 hours exposure, respectively. More than six corroded areas per sq. ft. of surface visible to unaided eye or any corroded area larger than $\frac{1}{16}$ inch in diameter shall be cause for rejection.

Water-Resistant Test (Type III only) — Paint coatings, applied under specific conditions, shall not blister after immersion in distilled water, pH 5.0 - 7.0, at 75°F. minimum, for 24 hours.

Adhesion — When examined at a magnification of 4 diameters, plating shall show no separation from basis metal when specimen is bent through 180 degrees on a diameter equal to the thickness of specimen.

Thickness — May be determined by microscope method, approved magnetic method or drop test using a solution of 200 gms. chromic acid, 27 milliliters sulfuric acid, distilled water to make 1 liter. A drop test conversion table to thickness is included in the specification.

Military Specification MIL-P-6871, 7 August 1950

Supersedes AN-P39a and is identical to AN-P-39a, Amendment -2, dated 13 May 1948)

Plating, Chromium

TYPES AND CLASSES:

Type I — Thin deposits (decorative)
Type II — Heavy deposits
Class A — Plated to dimensions.
Class B —Ground to dimensions after plating.

THICKNESS:

Type I — 0.00002 inch, minimum.

Type II — 0.002 inch, minimum, unless otherwise specified. For Class B deposits, this thickness applies after all machining or grinding operations have been completed.

May be determined by microscope method, magnetic method, micrometer, stripping or dropping tests.

ADHESION:

When examined at a magnification of 4 diameters, plating shall show no separation from basis metal when specimen is bent through 180 degrees on a diameter equal to the thickness of the specimen and then straightened.

HYDROGEN EMBRITTLEMENT RELIEF:

All parts having hardness greater than Rockwell C-40 shall be baked 375° ± 25°F. for 3 hours.

Federal Specification QQ-P-416, Amendment -1, dated June 1, 1951

Plating, Cadmium (Electrodeposited)

CLASSES AND THICKNESS:

Class A: 0.0005 in. thick, average minimum[1]
Class B: 0.0003 in. thick, average minimum[1]
Class C: 0.0002 in. thick, average minimum[1]

Note[1] — No single minimum value shall be less than 70% of this value.

TYPES:

Type I: Without supplementary chromate or phosphate treatment.

Type II: With supplementary chromate treatment, primary purpose of which is to retard or prevent white corrosion products.

Type III: With supplementary phosphate treatment, primary purpose of which is to form a paint base.

GENERAL:

In general, undercoatings shall not be used.

In general a light or dull finish is acceptable.

Parts with hardness greater than Rockwell C-40 shall be stress-relieved before cleaning and plating if they contain objectionable residual stress.

Springs or other parts subject to flexure or repeated impact and with hardness greater than Rockwell C-40 shall be baked after plating, and prior to any flexing or supplementary treatment, at 375° ± 25°F. for 3 hours. Parts previously heat treated below 375°F. shall receive an approved baking.

Anodes or baths containing mercury shall not be used.

For aeronautical use, unless otherwise specified, Class B, Type I shall be furnished, except for certain threaded and close tolerance parts and areas where controlled deposits cannot be normally obtained.

DETAIL REQUIREMENTS:

Salt-spray — ("standard 20%" solution) — Type II shall show no white corrosion products after 96 hours exposure.

Specimens shall show no corrosion products of the basis metal after the exposures shown in the following table. More than six corroded areas per sq. ft. of surface visible to unaided eye or any corroded area larger than $\frac{1}{16}$ inch in diameter shall be cause for rejection.

Type	*Class*	*Hours Exposure*
I and III	A	240
	B	192
	C	96
II	A	336
	B	288
	C	192

Water-Resistant Test (Type III only) — Paint coatings, applied under specific conditions, shall not blister after immersion in distilled water, pH 5.0 - 7.0, at 75° F. minimum, for 24 hours.

Adhesion — When examined at a magnification of 4 diameters, plating shall show no separation from basis metal when specimen is bent through 180 degrees on a diameter equal to the thickness of specimen.

Thickness — May be determined by microscope method, approved magnetic method or drop test using a solution of 200 gms. chromic acid, 27 milliliters sulfuric acid, distilled water to make 1 liter. A drop test conversion table to thickness is included in the specification.

Ordnance Department U. S. Army Tentative Specification AXS-1601, 8 May 1945

Lead Alloy, Hot Dip (For Iron and Steel Parts)

Covers hot-dip lead alloy coating applied to iron and steel parts.

Types: A. Low tin content
B. Medium tin content
C. High tin content

Compositions:

Percent	*Type A*	*Type B*	*Type C*
Lead (min.)	93.5	89.0	67.0
Tin (max.)	5.5	6.5 to 8.5	
Bismuth (max.)		1.5	31.0
Antimony (max.)			1.0
Other elements (max.)	1.0	1.0	1.0

Thickness: Not less than 0.0002 inch. May be measured by magnetic gage or microscopic method.

Salt Spray: There shall be no rust spots exceeding

1/16 inch diameter after following exposures to "standard 20%" solution:

Type A — 48 hours
Type B — 72 hours
Type C — 96 hours

Navy Department Specification 46Z3, September 1, 1944

Zinc-Coating (Hot-Dip Galvanizing)

Composition of bath:

Lead[1] (max.)	1.60%
Iron[1] (max.)	0.08
Aluminum + tin (max.)	0.02
Cadmium[1] (max.)	0.75
Zinc	Bal.

[1]When cadmium exceeds 0.41%, total lead, iron and cadmium shall not exceed 1.25%.

Coated articles shall not be withdrawn from bath through volatile flux cover such as produced by adding ammonium chloride.

Thickness of coating:

On wrought steel: Maximum obtained while object comes up to bath temperature of 865°F. max.

On castings: Maximum obtained while object comes up to bath temperature of 840°F. max.

Federal Specification O-G-93, 29 November 1949

Galvanizing Repair Compound

Covers galvanizing repair compound for regalvanizing welds in galvanized steels and for repairing galvanizing without the use of supplementary flux.

Forms and Material:

(1) Powder — Shall be a finely divided alloy of prime zinc, tin and lead combined with a flux of zinc or ammonium chloride. It shall not turn liquid in the container when exposed to the atmosphere.

(2) Stick — The stick shall be cast from prime zinc, tin, and lead, in combination with fluxing ingredients.

Liquefaction — Compound shall be completely liquid at a minimum temperature of 475°F.

Rust resistance — When applied to steel, shall show no rusting in coating or at junction of coating and galvanizing when subjected to "standard 20%" salt-spray test for 100 hours.

Performance — Shall be capable of suitable application to hot dipped or electro-galvanized steel plates in flat, vertical and overhead positions for repairing both galvanizing and regalvanizing welds.

Military Specification MIL-M-6874, 7 August 1950

(Supersedes but is identical to AN-M-8a, dated 5 April 1948)

Metal Spraying, Process For

Covers general requirements for apparatus, material and procedure for metal spraying parts for protection against corrosion and for building up worn metal surfaces. Spraying may be done with coating material in wire or powder form.

Apparatus — Oxygen and acetylene spray gun, air cleaner with oil and water extracter and surface preparation equipment.

Surface Preparation — After cleaning, all surfaces shall be roughened by sand blasting, machine tool operation, electric bonding or combination of these, under specified conditions.

Worn Bearing Journal Surfaces: After preparing surfaces, the minimum thickness of deposited metal, *after finishing*, shall be as follows:

Diam. of Shaft	*Reciprocating Rods and Light Duty Journals, etc.*	*Heavy Duty Journals Cranksha/ts, etc.*	*Press Fits*
Less than 3 in.	.030	.040	.020
3 to 6 in.	.040	.050	.030
Over 6 in.	.050	.060	.040

Aluminum Coatings — On aluminum alloy, coatings of 0.002 to 0.004 in. thickness are optimum. On steel, heavier coatings may be used since anchorage is better.

Treatment After Spraying — After light abrasion cleaning, whenever possible aluminum coated steel structural parts not to be painted shall be boiled 30 minutes in a 15% solution of potassium dichromate, and then thoroughly rinsed and dried.

Forms of Materials: Wire: Aluminum, babbit, brass, bronze, cadmium, copper, low carbon-high carbon and corrosion resisting steel, lead, Monel, nickel, tin and zinc wires are standard in sizes .125 in. and .091 in. diameter and are covered by Specification AN-W-20.

Powder:

Metal	*Nominal Mesh*	*Metcl*	*Nominal Mesh*
Aluminum	300	Bronze	300
Zinc	300	Tin	150
Brass	150	Lead	200
Copper	300	Nickel	300

NOTE: To eliminate foreign matter or large particles, metallic powder must be sifted through an 80 mesh screen.

CLEANING PREPARATION, SURFACE TREATMENT AND CONDITIONING

Military Specification MIL-C-15205 (Ships), 1 June 1950

(Supersedes Navy 52C16a, 16 April 1945)

Compound, Metal-Conditioning

Covers a metal-conditioning compound for use in connection with preservation of cargo-tank surfaces, deck machinery, etc., and in general in locations where disintegration of rust scale or rust inhibition is required.

Types: I — Light
II — Heavy

Qualification: Required.

Composition: Shall consist essentially of petroleum derivatives, free from added kerosene or essential oils. Shall be homogeneous liquid between 10° and 90°F.; of such viscosity as to be capable of being applied by spray equipment or by hand brush; noncorrosive; rust-inhibitive; harmless to personnel; and noninjur-

ious to wood or painted surfaces. When applied to ferrous surfaces on which rust scale, etc., has formed, it shall render the rust, scale, etc., capable of being readily removed by wire brushing within specified conditioning period (see below). After conditioning and wire brushing, surface shall be in proper condition to receive a coat of zinc chromate primer.

Physical Requirements:

	Type I	*Type II*
Flash Point (open cup)	Not less than 280° F.	Not less than 315° F.
Viscosity at 100°F. (Saybolt universal seconds)	100 - 120	300 - 370
Adhesion and Protection	Resist special, non-standard salt spray test for 5 days	Resist special, non-standard salt spray test for 10 days
Conditioning Period (max.)	90 days	12 months

Interim Federal Specification P-R-791 (Navy), (Ships) Amendment -2, 20 August 1953

(Superseding Amendment -1, 10 June 1953)

Rust Removing Compound Phosphoric Acid Base)

(For use on Ferrous Metal Surfaces)

Covers a concentrated phosphoric acid compound to be diluted with water for removal of rust from ferrous surfaces in presence of light grease and oil.

Qualification — Required.

Composition — Shall be phosphoric acid base, clear liquid, free of sediment, abrasives and coloring agents. Compound shall be free from poisonous substances, shall not give off injurious fumes or vapors, shall contain not more than 5 parts per million of arsenic and shall contain no mineral acids or their salts (except for phosphoric acid). It shall contain not less than 6% free orthophosphoric acid (weight to volume basis) and not less than 5% (by volume) water-soluble organic solvent. The "control formula" given, not a guarantee of acceptability, is as follows:

Control formula

Phosphoric acid (85 percent), Milliliters	118.0
Wetting agent (Specification MIL-W-16791), milliliters	5.0
Butyl cellosolve, milliliters	12.5
Water, sufficient to being total volume in milliliters to	250.0

Flash Point: Not less than 135°F. (Tag closed cup).

Grease Removal: Diluted compound shall remove greasy films equal to or better than control formula. Greased panel, after immersion in diluted compound for 30 minutes and then rinsed in distilled water, shall show no "waterbreaks," except within 1/8 inch from edge of panel.

Inhibiting Agents: Shall not be present to interfere with free action of rust removing compound. If a new degreased ball bearing, immersed for 30 minutes in diluted compound is dulled to a lesser degree by the sample than by the control formula, it indicates the presence of inhibiting agents contrary to this specification.

Joint Army-Navy Specification JAN-C-490, dated 21 August 1947

Cleaning and Preparation of Ferrous Metal Surfaces for Organic Protective Coatings

Covers cleaning and preparation of iron and steel components for application of organic coatings. Does not apply to mechanical, automotive or other equipment covered by other specifications.

GRADES AND TYPES:

This specification covers the following grades and types of metal cleaning and surface preparation processes, as specified in the contract or order.

Grade I—A treatment which produces an adherent, crystalline phosphate deposit on a previously clean, ferrous, metal surface.

Grade II—Cleaning treatments which leave the metal surface substantially bare.

Type 1—Mechanical (sand, shot, grit, or seed blasting preceded by degreasing if necessary to assure a grease-free surface and followed by cleaning to remove dust and metal particles).

Type 2—Hot alkaline cleaner (immersion, spray or electrocleaning).

Type 3—Solvent (immersion, spray or vapor degreasing).

Type 4—Alcoholic phosphoric acid cleaner.
(a) Used alone.
(b) Following other cleaning.

Type 5—Hot phosphoric acid cleaner containing a detergent.
(a) Used alone.
(b) Following other cleaning.

Type 6—Emulsion cleaner (used with water, or applied directly and followed by a water rinse).

REQUIREMENTS:

Applicable methods — Shall be suitable to nature and degree of contamination. Sulfuric or hydrochloric acid pickling require specific approval and when used shall be neutralized in alkaline bath followed by chromic or phosphoric acid rinse.

Freedom from oils, greases, etc.: Cleaning shall be done until rinsed surfaces are free of water-break.

Freedom from alkalies and strong acids — After final rinse, surface shall be at pH 3.0 to 7.0 when tested with indicator papers (such as congo red and litmus paper) or indicator solutions.

Freedom from smut — A white cleansing tissue shall show no deposit when wiped over cleaned, dry surfaces.

Paint adherence — Thoroughly dried coat of primer or other protective coating shall be tested by pressing to it a 2 inch length of moisture-resisting masking tape, which is then peeled back on itself. Not more than 5 specks of bare metal or phosphate coating, nor 1 spot larger than 1/8 inch average diameter, shall be exposed.

Flexibility — There shall be no cracking or flaking at bend when panel is bent rapidly through 180 degrees over a 3/8 inch mandrel.

Phosphate coating weight (Grade I only) — The loss

in weight after stripping in a 10% sodium hydroxide solution shall be as follows:

For parts treated by immersion or spraying: 150 mg./sq. ft.

For coated sheet to be fabricated after painting: 40-100 mg. sq./ft.

Salt spray resistance (Grade I only) — A specimen shall be painted with 0.7 to 1.2 mils of enamel (U. S. Army Specification 3-181, Type II) or zinc chromate primer (Army-Navy Aeronautical Specification AN-TT-P-656), as specified and scribed through to untreated surface, with two perpendicular lines each 2 inches long. After exposure to "standard 20%" salt spray test for 250 hours, there shall be no rust or softening or blistering of paint beyond 1/8 inch on either side of scratch.

Water resistance (Grade II only) — Panels painted as above and suitably dried, after immersion in distilled water of pH 5.0 to 7.0, at 75°F. minimum, for 24 hours, shall not show more than the following:

(1) The appearance of more than one blister more than 1/8 inch long.

(2) The appearance of more than two lines or ringlets of blisters.

(3) The appearance of ten or more blisters 1/8 inch or less in length other than the lines or ringlets.

U. S. Army Specification No. 57-O-2C, Amendment 2, 16 January 1945

(Superseding Amendment 1)

Finishes, Protective, For Iron and Steel Parts

Covers protective coatings and treatments applied to iron and steel parts.

TYPES AND CLASSES:

Type I Finish. Plating (electrodeposited coatings)

Zinc, Classes GS, LS, RS, GSC, LSC and RSC.
Cadmium, Classes NS, OS, TS, NSC, OSC and TSC.
Nickel, Classes FS, KS and QS.
Chromium, Decorative.
Chromium, Service.
Lead, Classes ES, MS. PS, EES, MMS and PPS.

Type II Finish. Phosphate coating

Class A. Phosphate coatings finished with non-drying petroleum oils containing corrosion inhibitors, suitable for use on sliding or bearing surfaces.

Class A-1. Phosphate coatings finished with non-drying petroleum oils containing corrosion inhibitors, suitable for use on sliding or bearing surfaces and with the build-up limited to a maximum of 0.0003 inch per surface.

Class B. Phosphate coatings finished with a rust-preventive suitably reduced for application and containing corrosion inhibitors. This finish is for use on non-moving parts only and shall be substantially dry to touch.

Class C. Phosphate coatings suitable for finishing with paint products.

Type III Finish. Oxide black coatings (excluding paint products)

Class A. Alkali Oxidizing Processes.

Grade 1. Oxide coatings finished with non-drying petroleum oils.

Grade 2. Oxide coatings finished with rust-inhibiting lacquer.

Grade 3. Oxide coatings finished with synthetic resin coating.

Class B. Chromate.

Class C. Fused Salts.

DETAIL REQUIREMENTS TYPE I FINISH:

Zinc, cadmium and *service chrome* shall be deposited directly on base metal without preliminary coatings.

Nickel or chrome, decorative. Intermediate copper coating is optional and subject to thickness requirement below. Where chrome is specified, nickel or copper plus nickel shall not be less than thickness requirements below.

Lead. Intermediate copper coating is optional.

Thickness. Unless otherwise specified, minimum values are given below in inches:

ZINC

Class	*Thickness, Inch, Minimum*
GS and GSC	0.001
LS and LSC	0.0005
RS and RSC	0.00015

CADMIUM

Class	*Thickness, Inch, Minimum*
NS	0.0005
OS	0.0003
TS	0.00015

LEAD

Class	*Thickness, Inch, Minimum*	
	Copper	*Lead*
ES		0.001
EES	0.000015	0.001
MS		0.0005
MMS	0.000015	0.0005
PS		0.00025
PPS	0.000015	0.00025

NICKEL AND DECORATIVE CHROME

Class	*Thickness, Inch, Minimum*		
	Copper Plus Nickel	*Nickel*	*Chromium*
FS	0.00125	0.0006	0.00001
KS	0.00075	0.0004	0.00001
QS	0.0004	0.0002	0.00001
Service Chromium, Thickness, Inch Minimum			0.0002

SALT SPRAY REQUIREMENTS:

Type I Coatings shall show, after the exposure periods, listed below, no white salts or iron rust, except that the following classes of Type I must not show more than 6 corroded areas per sq. ft. or 2 corroded areas on parts having a total surface of less than 1/3 sq. ft. or any corroded areas larger than 1/16 inch in

diameter: FS, KS, QS, ES, EES, MS, MMS, PS and PPS. The exposure times are:

Class	Hours White Salts	Hours Red Rust
GS		72
LS		48
RS		24
NS		72
OS		48
TS		24
FS		72
KS		48
QS		16
ES and EES		96
MS and MMS		48
PS and PPS		24
GSC	24	96
LSC	24	72
RSC	24	48
NSC	24	96
OSC	24	72
TSC	24	48

Adhesion — Coatings on specially prepared panels shall not crack or flake when tested as follows: (a) Immerse panels for 5 minutes in boiling water and transfer immediately to cold tap water for 5 minutes. Repeat for 5 cycles. (b) Other panels shall be bent rapidly and repeatedly through 180 degrees over ½ inch mandrel until specimen fractures.

DETAIL REQUIREMENTS TYPE II AND TYPE III FINISHES

Salt Spray — Finishes shall show no corrosion after following exposure periods:

	Before applying the supplementary finishing material	After applying the supplementary finishing material
Type II Finish:		
Class A	1 hour	24 hours
Class B	2 hours	36 hours
Class C	no test required	250 hours
Type III Finishes		
Class A		
Grade 1	½ hour	2 hours
Grade 2	½ hour	16 hours
Grade 3	½ hour	24 hours
Class B	½ hour	24 hours
Class C	½ hour	24 hours

Unless otherwise specified, Type II, Classes A and B and Type III, Class A, Grade 1 shall be coated with a rust inhibiting oil or compound and then centrifuged or drained. Type II, Class C shall withstand the salt spray test after a prescribed painting without showing rusting or loss of paint adhesion beyond ⅛ inch of a scratch mark made to the base metal.

Coating Weight — Type II class finish shall have a minimum phosphate coating weight of 150 mg. per sq. ft.

Hydrogen Embrittlement Relief — Baking specified in contract shall be applied to springs and other parts subject to flexure or replated impact.

Abrasion Resistance (Type III Class C only) — Steel panels shall have abrasion index number not less than 100 when tested on a Taber Abraser with a CS-17 Calibrase Wheel under a 1000 gm. load until finish has been worn away approximately 50%.

Thickness Testing — May be done using magnetic gage, microscope, chromic acid dropping test for zinc and cadmium, spot test for chrome, acetic acid-peroxide dropping test for lead.

Military Specification MIL-C-12968 (ORD), 11 August 1953

(Superseding (in part) U. S. Army 57-0-2, 11 December 1943)

Coatings, Phosphate, Protective (For Iron and Steel)

Covers phosphate protective coatings for iron and steel, as described further under "Classification" below, for use with supplementary finishes and dyes.

CLASSIFICATION:

Type A — Manganese base phosphate coatings.

Coatings for use with a supplementary petroleum base finish, or for use as a base for paint; or for paint in combination with a petroleum base supplementary finish or sections other than those receiving paint. Intended for application to parts expected to be in contact with alkaline materials or exposed to temperatures above 225°F. Same as Type II, Class A of Specification 57-O-2C.

Type B — Zinc base phosphate coatings.

Class 1 — Coatings for use with a supplementary petroleum base finish, or for use as a base for paint, or for paint in combination with a petroleum base supplementary finish on sections other than those receiving paint. Intended for application to parts not expected to be in contact with alkaline materials nor exposed to temperatures above 225°F. Same as Type II, Class B of Specification 57-O-2C.

Class 2 — Inorganic salt sealed zinc base phosphate coatings for use with a dye and/or supplementary finish. Intended for application to fire-control instruments.

Process Details Approval — Required. Should be submitted through contracting officer to the bureau or agency concerned, before commencement of operation.

REQUIREMENTS:

Continuity of coating — Coatings shall show no signs of corrosion when subjected to boiling distilled or deionized water for at least ten minutes, in accordance with a specified, detailed test procedure. Optionally, the "standard 20%" salt spray test may be used with exposure times as follows (for bare phosphate coatings):

Type A	1 hour	
Type B, Class 1	2 hours	
Type B, Class 2	24 hours	(sealed with inorganic salt)
	40 hours	(sealed and dyed)

Coating weight — Determined by loss-in-weight method, stripping Type A coatings in 5% chromic acid

solution at 165°F. and Type B coatings in a solution of 180 gms sodium hydroxide, 90 grams sodium cyanide, water to make 1000 ml., room temperature. Minimum coating weights shall be as follows:

Type A	1500 milligrams/sq. ft.
Type B, Class 1	1000 milligrams/sq. ft.
Type B, Class 2	(Prior to sealing) 1000 milligrams/sq. ft.

Supplementary Finish — Shall be in accordance with applicable paint, preservative or end-item specification. Weight of finish shall be determined by stripping in successive baths of petroleum ether or naphtha or by trichlorethylene vapor degreasing.

Appearance — Coatings shall be uniform and of even color, gray to black except for Type B, Class 2 which shall be dyed to specified color.

Military Specification MIL-C-16232 (BuOrd), 2 May 1951

Coatings-Phosphate: Oiled, Slushed or Waxed (For Ferrous Metals Surfaces) and Phosphate Treating Compounds

Covers phosphate coatings for iron and steel and compounds for producing them. The coatings are not intended as surface treatments prior to painting.

CLASSIFICATION:

Type I — Coatings on bearing surfaces, where a matte finish with a moderate degree of corrosion resistance is required to prevent wear and assist in "break-in" of bearing surfaces. These coatings must be impregnated with oil conforming to Specification MIL-L-3150 after specified processing.

Type II — Coatings on surfaces of non-moving parts, where a matte finish with somewhat more corrosion resistance than Type I is required. These coatings must be impregnated with acceptable rust preventive compounds after specified processing.

Process and Compound Qualification: Required.

Compounds (for Government Procurement):

	Spec. Grav. 60/60°F. (min.)	Percentage by wt. (min.)			
		Mn	PO_4	Zn	NO_3
For Type I Coatings	1.34	6.5	25.0	—	—
For Type II Coatings	1.52	—	30.0	11.0	5.8

Prevention of Hydrogen Embrittlement — All parts of hardness over Rockwell "C" 40 including springs and other parts subject to repeated flexure shall be suitably stress relieved before cleaning and baked one hour at 210°-220°F. after rinsing, subsequent to phosphate treatment.

COATING REQUIREMENTS:

Thickness: Type I — 0.00020 to 0.00040 in.
Type II — 0.00020 to 0.00050 in.

Thickness shall be determined by difference in readings before and after stripping in a 20-30% chromic acid solution at 155°F. Magnetic method also permitted.

Salt Spray — Coated part shall show no corrosion after exposure to "standard 20%" salt spray test for following intervals:

	Without Impregnation	*With Impregnation*
Type I	1½ hours	24 hours
Type II	2 hours	48 hours

Abrasion Resistance (Type I only) — Coatings not impregnated shall withstand an average of 300 cycles and a minimum of 200 cycles when tested on a Taber or equal tester using wheels equivalent to Taber Abraser CS-15 Calibrase under a load of 500 grams on each head.

CONVERSION COATINGS, ANODIZING

Military Specification MIL-T-12879 (QMC), 7 July 1953

Treatments, Chemical, Prepaint and Corrosion Inhibitive, For Zinc Surfaces

Covers prepaint and corrosion inhibitive treatments for electroplated, hot-dipped and solid zinc surfaces.

CLASSIFICATION:

Type I Prepaint
- Class 1 — Phosphate
- Class 2 — Chromate

Type II Final Finish (Chromate)

SEQUENCE OF OPERATIONS:

(a) Cleaning

(b) Treatment (as per chemical supplier)

(c) Rinsing

Type I Class 1. Clean water followed by diluted chromic acid or chromic-phosphoric acid solution at pH 2.0 to 6.0.

Type I Class 2, and Type II. Water shall not exceed 150°F. unless process is specifically designed for higher temperatures.

(d) Drying. Without delay, at temperature not above 250°F. for Type I Class 1 and not above 150°F. for Type I Class 2 and Type II, unless process is designed for higher temperatures.

PROPERTIES:

Insoluble phosphate film shall weigh not less than 150 milligrams per sq. ft., when determined by loss in weight after stripping in fresh 25 gram per liter chromic acid solution at 50°C.

Type I treatments, when painted under specified conditions, shall show no loss of paint adhesion when scored through to metal for several inches and immersed in distilled water at 73.5 ± 2°F. for 24 hours, and examined immediately upon removal from water.

Type II treatments, after aging for 24 hours, shall withstand salt spray for 96 hours per method 606.1 of TT-P-141 without appearance of white corrosion products.

(To be concluded next month)

Surface Treatment and Finishing of Light Metals

Conclusion of Part II. Corrosion and Protection of Aluminum

By S. Wernick, Ph.D., M.Sc., F.R.I.C., F.I.M., and R. Pinner, B.Sc.

Protection by Metal Spraying

More recently, experiments have been carried out in order to obtain similar results to those obtained in cladding. High purity aluminum is sprayed by either the wire or the powder method. The main advantage of this type of process consists in the ease of application irrespective of the size or shape of the component. Where the surface is subsequently to be painted, the rough porous sprayed coating will also give good adhesion without further pre-treatments. On the other hand, the mechanical strength and elongation of sprayed deposits are generally poor nor can this method be employed where a smooth surface is required. Good results have, however, been obtained by spraying 99.95% aluminum onto less corrosion resistant alloys as well as for protection in marine conditions, where experiments have been carried out also with zinc-sprayed coatings.

Corrosion Testing

Corrosion tests are undertaken for three main reasons, (1) to direct the choice of material or protective system for particular service conditions, (2) predict the behavior of the material in service, and (3) to set up performance standards either for design or in routine inspection or material control.

The determination of the corrodibility of a metal or an alloy is difficult for two main reasons.

Corrosive influences in service conditions vary with the specific environment and type of chemical attack. Thus, to give a common example, an alloy may stand up to the sooty and sulphurous atmosphere of an industrial town, but may be poorly resistant to marine conditions, and vice versa. A corrosion test must, therefore, simulate the condition of service of the metal as nearly as possible, and the value of a metal under one type of exposure is only a limited guide to its behavior under different conditions. It is, furthermore, often difficult to compute results of corrosion tests, as their measurement is usually dependent either on visual examination, on specialized factors such as loss of mass, or mechanical strength, (e.g., elongation, etc.) or on potential measurements, which do not necessarily give a complete guide to the value of the material under service conditions.

Broadly, we may distinguish in practice between two types of corrosion tests: (1) field tests, and (2) accelerated tests carried out in the laboratory.

FIELD TESTS:

In these, the resistance of the metal to corrosion is determined directly and, as far as possible, under the actual service conditions; hence, this type of test, which was mainly developed in America under the direction of the American Society for Testing Materials and the Aluminum Research Laboratories, is the most accurate method of predicting the behaviour of the material, and of comparing individual metals or alloys, or of, e.g., different treatments. Their main disadvantage is the length of time required to show results. Particularly on the more resistant metals, many years exposure will often be required until accurate results are obtained. Such tests are usually carried out (1) in the atmosphere (2) by immersion in water, and (3) in special media. Even in field tests, however, it is often easy to draw the wrong conclusions unless the type of exposure is precisely corelated to the service requirements.

Many different types of atmosphere are to be found, for example, and an extensive corrosion testing program will test specimens in several locations. Thus, Champion in his comprehensive book on the subject of corrosion testing[33] lists eight classes which may be used, including rural, urban, industrial, urban-marine, industrial marine, marine, tropical and tropical-marine.

Similar reservations in prediction of behavior must be made in the case of immersion tests. Not only is there a large difference between the effect of fresh water and sea water on corrosion properties, but individual alloys behave differently according to the pH of the water, its gas content (particularly oxygen) while more recently research has indicated the importance of small traces of metals or inhibitive compounds[34] as well as of secondary effects such as movement relative to the water, in rivers or tides.

The results of such tests are assessed by (a) visual signs of corrosion, (b) changes in mass of the specimen, and (c) changes in the metal's mechanical properties, more particularly by determining the loss in tensile strength and elongation of groups of tension specimens and computing their variation from similar specimens stored indoors over the same period by a method worked out for the purpose.[52] The results of visual examination and weight changes of the panels are recorded (a) without removing the corrosion products, and (b) by cleaning and measuring the loss in weight. Finally, the depth of attack is determined either by micrometer depth gauge or by sectioning, polishing and measuring with a microscope fitted with a micrometer eyepiece.

With the reservations stated, these tests have great value for the measurement of corrodibility under actual exposure, and interesting results have been

Table VII

Changes in Tensile Strength of Wrought Aluminum Alloys[53]

(Figures given are expressed as percentages)

	Point Judith B.I.				*New Kensington, Pa.*				*Georgetown, Brit. Guiana*				*Edgewater, N. J.*			
Exposure (years)	*1*	*2*	*4*	*10*	*1*	*2*	*5*	*10*	*1*	*2*	*5*	*10*	*1*	*2*	*5*	*10*
Alloy																
2S-O	—1	—2	—2	—7	—1	—1	—2	—4	0	0	—2	—1	—1	—2	—1	—3
2S-H	—1	—3	0		+1	—1	—2	—4	0	0	0	—1	0	—1	0	—4
3S-O	—2	—1	—1	—4	—1	—2	—2	—5	0	—1	—2	0	0	—2	—6	—5
3S-H[2]	—1	0	0		+2	—2	—1	—4	0	0	0	0	—2	—1	—1	—3
17S-T	—9	—11	—13		—4	—4	—5	—8	—2	—3	—4	—1	—5	—4	—7	—6
24S-T	—7	—10	—12		—5	—4	0	0								
52S-½H	—1	—1	—1		—1	—3	+2	—5								
53S-T	—2	—6	—5		—1	+2	—6	—8								
61S-T	—3	—5	—8	—9*	—4	—2	—6	—8								
Alclad																
17S-T	0	—3	—1†	—3	—1	0	—1	—1	+3	+2	0	+1	+1	+2	—1	0
24S-T	0	—1	+1‡	—1	0	0	—1									
3S-O	—1		—2‡		—2											

Test pieces — Machined-tension specimens, 0.064" thick.
(—) values "loss" in strength (against indoor-outdoor specimens).
(+) values "gain" in strength.
(*) exposed 8 years.
(†) exposed 5 years.
(‡) exposed 6 years.

obtained of the comparative value of many metals and alloys (see Table VII).[53]

As well as the weather-exposure tests mentioned above, marine testing stations have been established at Kure Beach and elsewhere[54] where alloys may be tested by research institutions and industrial concerns.

Laboratory Tests

Field tests take a long time, samples often being exposed for many years or even decades.. Laboratory tests normally fall into two classes: (a) accelerated corrosion tests, which intensify one or more of the normal corrosive influences to a point where the testing time may be reduced to a period varying from a few minutes to several months, and (b) physical or electrochemical tests designed to predict the behavior of the material from its properties.

Various accelerated corrosion tests have been developed for aluminum. As early as 1922 Mylius[55] suggested a qualitative test based on the rate of hydrogen evolution on immersion in normal hydrochloric acid.

Early methods were, however, unreliable, and laboratory testing is now carried out by exposure to salt solution or in conditions of controlled humidity. Various methods utilizing contact with salt solution are in use, in which the specimens are either subjected to salt spray or are tested in an alternate wet-and-dry immersion apparatus, etc. The solutions used contain various strengths of sodium chloride. Frequently the tests are further accelerated by the addition of hydrochloric acid (used mainly in Britain) or hydrogen peroxide which is sometimes found in small quantities as a corrosion product of aluminum (used mainly in the U.S.A., Germany, etc.). Reproducible results are thus obtained by using a solution containing sodium chloride 3%, hydrogen peroxide 0.1%.

More strongly oxidized solutions are generally to be avoided. Similarly the hydrochloric acid concentration should not exceed 1%, and the best reproducibility is obtained at above pH 3.0.[33] Under these conditions the correlation between salt spray tests and outdoor exposure tests is often satisfactory, and while the former are naturally most valuable when predicting comparative values of corrodibility under marine conditions, they also give a useful qualitative companion for materials testing.

Apart from the simple tests described, more elaborate methods have been developed to simulate exposure conditions more closely, but also to determine stress corrosion fatigue and performance under conditions of mechanical action, e.g., erosion or vibration (fretting corrosion). An interesting example of such a method is the Rotor test[35] developed at the Chemical Research Laboratories, Teddington, to test specimens under conditions of erosion in sea water. In this method the specimens are rotated, while immersed, at controlled temperature and variarble speeds. Accelerations of up to fifty times the normal corrosion-erosion rates may be obtained. Similar results are also obtained with jet impingment tests.

Several methods have been developed for testing susceptibility to stress corrosion. In one type, the specimens are subjected either to equal stress or an equal percentage (e.g., 75%) of their proof stress or yield strength, while it may be possible to watch the progress of stress corrosion cracks under the microscope.[36] Other tests in which the strain is kept constant, have been developed in Germany and the U.S.A.[57]

In an attempt to produce an accelerated test while simulating service conditions as nearly as possible, several complicated weathering cycles have been found useful, particularly for parted specimens. These consist

of regular sequence of e.g., intermittent spraying or immersion, drying by radiant heat, refrigeration, etc. The affect of sunlight may be simulated by ultra violet radiation produced by a carbon-or mercury arc.[33]

Assessment of Results

Apart from tests in which only the mechanical properties are under test, it is necessary to remove corrosion products after completion, both for visual examination or for determining the loss of weight in metal. Before this is done, specimens may be weighed in order to determine the weight of corrosion product, and may be photographed to provide a permanent record. Aluminum oxide is then removed, e.g., in concentrated nitric acid. To correct the result for dissolution of aluminum, a factor may be applied; e.g., it has been found[41] that the loss in weight of commercial aluminum in concentrated nitric acid is 0.3 g./sq.cm. in 15 min. at 15°C. It is generally better, however, to use a control. Scrubbing the specimen may be necessary particularly after field tests. Oxide may also be removed from aluminum by methods in use for stripping anodic coatings, e.g., boiling in 35 cc./l. phosphoric acid (85%), 20 g./l. chromic acid solution.[38,43] After cleaning, the specimens may be reweighed.

The results of corrosion tests are generally subject to high percentage deviations and particularly in field tests it is usual to use up to twelve replicates while statistical methods have proved valuable in increasing the accuracy.

One such method for assessing results has been developed by the American Society for Testing Materials, and is described by Darrin.[13] After exposure, the specimens are examined and rated under five headings, as follows

Examined for	*Rating*				
	None	*Slight*	*Moderate*	*Bad*	*Very Bad*
Discoloration	3	2	1	0	0
Roughening	4	3	2	0	0
Local corrosion	9	6	3	0	0
General corrosion	12	9	6	3	0
Depth of pits (in.)	0.001	0.001-0.004	0.005-0.0014	0.015-0.030	0.030
Rating	12	9	6	3	0

The total ratings (out of a maximum of 40) is then multiplied by 2.5, the final assessment being:

Rating (%)	*Designation*
100	Perfect
95-99	Excellent
89-94	Good
75-84	Fair
65-74	Poor
64	Bad

Where required, a separate rating may also be given to the testing solutions.

Statistical methods have also been developed for assessing, corrosion ratings in terms of depth and frequency of pits, may be expressed as a penetration factor, while visual examination of corrosion has also been aided by colorscopic methods. In one such method,[45] 1% ammonium chloride is added to a 10% gelatin solution, hydrogen peroxide being added to a small portion of the solution before mixing with the bulk. Finally, 1% of a 10% alcoholic solution of hematoxylin is added and the final solution brushed or sprayed on to the cleaned surface when corrosion spots turn a deep violet.

Physical Tests

Several physical tests are in use in connection with corrosion testing. For a full description of these, reference should be made to the literature. They are often designed to measure the potential drop of the metal in solution. Apparatus for measuring the potential and current flow between the grain boundaries and the grains has been developed to test for intergranular corrosion, while other instruments have been designed for clad-alloying,[46] as have corrosion tests by X-ray.[56]

The Prevention of Corrosion

As has already been indicated, a high corrosion resistance is often incompatible with maximum strength, while even the more resistant alloys, such as the aluminum-magnesium alloys, must often be protected.

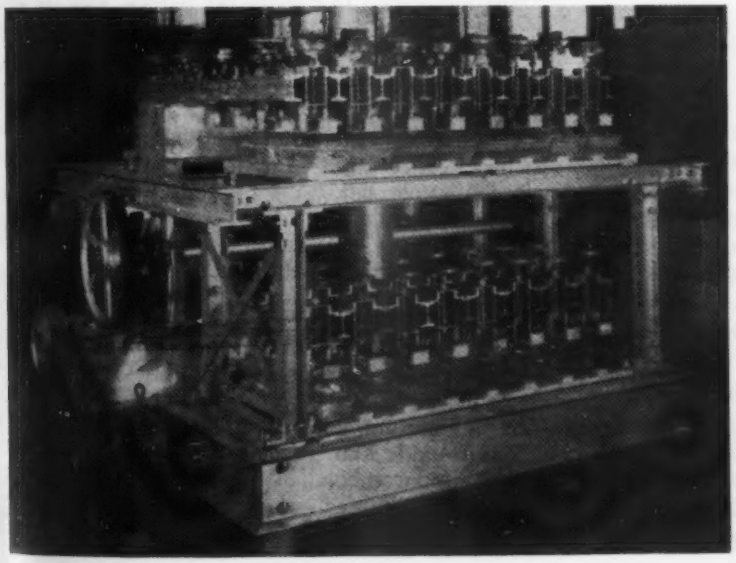
To ensure maximum corrosion resistance, the following general rules may be applied:—

(1) Correct choice of alloy in relation to service conditions — with special regard to purity in composition and strict material control.

(2) Careful control of casting and heat treatment.

(3) Correct design to avoid formation of concentration cells, e.g., cavities liable to fill with rain water or contact with dissimilar metals.

(4) The prevention of corrosion by the application of a finishing system suitable to the alloy (2) the use of corrosion inhibitors or (3) by cathodic protection.



Alternate-immersion testing apparatus. One of each pair of specimens in the fixtures above the top shelf is stressed as a simple beam by direct loading with lead weights. The specimens in the fixtures above the bottom shelf are not stressed. (R. B. Mears, C. J. Walton and G. B. Eldridge, Proc. A.S.T.M. 1944, preprint 29.)

Corrosion Inhibitors

The function of inhibitors is important in many protective finishing processes, e.g., they are incorporated in paint primers, as well as in cleaning solutions and chemical conversion treatments, where they stabilize the reaction between the solution and metal, and prevent rapid and irregular corrosion at the expense of film formation. They are also used in such specialized applications as water coolers, gasoline tanks, etc.

Where the immediate corrosion products of a metal are sparingly soluble, corrosive attack by an electrolyte may often be inhibited. Inhibitors, therefore, function by producing insoluble reaction products, or alternatively, by being themselves strongly adsorbed by the metal surface. They are either anodic or cathodic, according to their specific function.

Inhibitors employed with aluminum usually function anodically and both soluble or insoluble compounds are employed, the latter being used mainly in paint primers. Important examples are the chromates of zinc, barium, strontium, etc. Other inhibitors commonly used include soluble chromates or dichromates which exercise protective influence in neutral salt solutions and certain acids, where they increase anode polarization. Borates, phosphates and nitrates are frequently used in ethylene glycol anti-freeze solutions, while solutions containing methyl alcohol often contain chlorates and nitrites also. Lactates, acetates, borates and chromates have been suggested for use with aluminum containers for commercial alcohols, while sodium silicate (water glass) and fluosilicates are effective in alkaline solutions and are widely used to inhibit cleaning solutions.

Organic colloids are also frequently used to inhibit attack by alkalis, and agar-agar or gum arabic may reduce the corrosion velocity of a 10 per cent sodium-hydroxide solution by up to 80 per cent. Nitrogen-containing organic compounds, such as triethylamine, are useful in inhibiting attack by acid, and are added to degreasing tanks where they neutralize the hydrochloric acid formed by hydrolysis of trichlorethylene and other chlorinated hydrocarbon solvents. Another class of nitrogenous inhibitors, supposed to act cathodically was investigated by Jenckel and Woltman[51] who found that acridine and phenyl quinoline, a related compound, prevented attack by 3N hydrochloric acid.

The Oxide Film

When freshly abraded aluminum is exposed to the atmosphere, it is immediately covered with a thin film of oxide which protects it from further attack. Chemical analysis has shown the natural oxide film to be a hydrated aluminum oxide. Reports of its structure have been largely contradictory, though X-ray and electron-diffraction experiments have shown the film to be either amorphous or at any rate composed of extremely small crystals, too small to give a pattern.

Several distinct aluminum hydrates are known, including the α-and β-monohydrates, and the α-and β-trihydrates, while two crystalline oxides are known as α-and y-Al_2O_3 respectively.

The natural oxide film is generally only 0.0000002 to 0.0000006 in. thick, can conduct electricity and can function as an electrode in potential measurements indicating oxidizing and reducing potentials of a solution.

Breakdown of the film may be caused by several means, e.g., mechanical rupture, etc. Repair is normally instantaneous and takes place, according to one theory[58] by two types of corrosion, viz., differential aeration, and hydrogen evolution, the former being described as taking place by the following reactions:

$$3O_2 + 12E = 6O^{--} \quad \text{cathodic}$$
$$4Al - 12E = 4Al^{+++} \quad \text{anodic.}$$

Assuming that $0^{=}$ can exist in the thin hydroscopic water film, the two ionic products then diffuse over the minute distance, separating anode and cathode and combine to form the oxide

$$4\ Al^{+++} + 6O^{++} \rightarrow 2Al_2O_3$$

Thompson describes experiments carried out to trace film growth and breakdown, electrolytically. Visual evidence of hydrogen evolution was obtained on abraded aluminum and magnesium in neutral liquids, and this was confirmed by inflections on the potential temperature curve. The same author also suggests the possibility of the existence of two kinds of films, either stabilized or unstabilized as indicated by continuous abrasion experiments and potential measurement.

The rate of formation of the natural oxide film has been the subject of investigations by Champion[59] who found that on a freshly exposed surface that rate of film formation (i.e., corrosion) is logarithmic for a time of approximately two hours, after which there is a transition until film formation follows exponential law.

As in practice an aluminum surface is always covered with a very thin oxide film, the logarithmic growth is of no practical importance.

An induction period during which the corrosion velocity is accelerated for a time was found in some cases, especially with pure aluminum. Exceptions to the exponential rate of film formation are found in cases of very severe corrosive conditions, where stress or fretting corrosion is in evidence.

The importance of oxygen in the growth of the protective oxide film in alkaline solution e.g., N ammonium hydroxide was demonstrated by Rame. If 99.99% aluminum, abraded to remove the natural film, is immersed in ammonium hydroxide in air, the rate of attack falls off to negligible proportion in the course of a few days. In a nitrogen atmosphere, on the other hand, the attack is more rapid and persists.

Artificial Oxide Films

Very much thicker oxide films (Table VIIA) may be obtained artificially either by chemical or anodic treatment of aluminum and its alloys.

The structure of these films is different from the natural oxide films, chemical treatment giving rise to distinctly crystalline structures. Anodic oxidation, on the other hand, gives rise mainly to amorphous films at ordinary temperatures, which with increase in temperature become crystalline, though of very small grain-size.

Though the oxidation products formed naturally on unanodized aluminum at temperatures above 300°C. are distinctly crystalline and natural films probably

Table VIIA

Thickness of Oxide Coatings

Type of Coating	*Length of Treatment (min.)*	*Basis Metal*	*Thickness of coating in microns (μ) (= 0.001 mm)*	*inches*
Natural oxide film	—	Pure Al.	0.005 to 0.15	0.0000002 to 0.0000006
M.B.V.	10	99.5 Al	2.3	0.00005
	30	"	2.7	0.00015
	60	"	3.8	0.00015
	120	"	6.1	0.00024
	10	Al-Si	1.8	0.00007
	120	"	1.7	0.00031
	10	Al-Mn	1.7	0.000068
	120	"	8.1	0.000032
	10	Al-Mg-Si	1.9	0.000076
	120	"	8.3	0.00033
	10	Al-Cu-Mg	2.8	0.00011
	120	"	9.6	0.00038
Normal M.B.V. and Alrok.	—	—	1 to 2	0.00004 to 0.00008
E.W. (sodium silicate)	10	Pure Al	0.8 to 1.0	0.000032 to 0.000040
	30	"	1.0 to 1.1	0.000040 to 0.000044
	60	"	1.1 to 1.3	0.000044 to 0.000052
Sulphuric acid d.c.	—	Alloys low in Si and Cu	8 to 20	0.00032 to 0.0080
		Alloys high in Si and Cu	5 to 10	0.00020 to 0.00040
Chromic acid d.c.	—	—	2 to 5	0.00008 to 0.00020
Oxalic acid d.c.	—	—	10 to 50	0.0004 to 0.0024
Oxalic acid d.c. specially thick	—	—	30 to 100	0.0012 to 0.004
Oxalic acid d.c. cooled anode	—	—	up to 600	up to 0.24

take on a crystalline structure at these temperatures, electron-diffraction investigations[60] of anodic films heated to 650°F. showed no appreciable change in the amorphous structure. When sealed in water at above 80°C. both natural and anodic films were, however, transformed to Bohmite (γ-$Al_2O_3.H_2O$) which at 650°C. changed to γ^1-Al_2O_3.

The amorphous nature of these films has been reported also by N. D. Pullen[61] in a description of X-ray examinations of films on super-purity aluminum, who suggests also a difference in the anodic films produced in chromic as against sulphuric and oxalic acids, the former being practically anhydrous, while analysis of the latter showed the presence of approximately 1 molecule H_2O: 1 molecule Al_2O_3. At 600°C., this author also found a strong γ-Al_2O_3 pattern, while in contrast to the sulphuric acid film a crystalline structure was also obtained with oxalic acid films by boiling in distilled water. The crystal pattern obtained by these means agreed with the monohydrate form[62] rather than with patterns obtained for α- or γ-Al_2O_3.

When these films were ignited, weight losses suggested the presence of a dihydrate, though no other evidence of the existence of this form has been recorded. Contamination of anodic films by the anodizing acid was shown to be stronger in oxalic and sulphuric acid films than in chromic acid electrolytes, and comparative results showed the presence of up to 3% oxalic acid and 13% sulphate respectively, while a film produced in 3% chromic acid solution contained only 0.1% chromium together with water and oxygen. The authors suggest that, when boiled, an extra molecule of water contaminated with chromium may be held in the crystal lattice of the α-monohydrate.

Hardness of Films

While coatings formed by chemical treatment are relatively soft and sometimes even powdery, films formed anodically are usually extremely hard and adhere tenaciously. Table VIII gives some comparative hardness values. On the other hand, the coatings are not as brittle as might be expected and do not usually crack[63] until the material has been stretched beyond its elastic limit and brittleness may be further reduced by sealing the film in boiling water, or dichromate solution, etc.

The flexibility of a film diminishes rapidly with increase in thickness, a.c. oxalic and chromic acid films being rather more flexible than d.c. oxalic and sulphuric acid films, while hardness is in general increased with the use of d.c., low temperature, high concentrations and increase in current density and film thickness, the hardest films being obtained in cold sulphuric and oxalic acid.

Table VIII

Hardness of Materials (Bierbaum Test)[64]

Razor steel	1,550
Glass	2,000
Chromium	3,100
Aluminum	80
Aluminum, anodic-oxide film,	
soft finish:	
face of film	180
center of film	1,200
base of film	1,550
hard finish:	
face of film	140
center of film	3,000
base of film	5,000

Protective Properties

Artificial oxide films on aluminum have widely different protective values, depending on their thickness, method of production, pretreatment and after-treatment. A comparison of corrosion resistance of various anode finishes applied to an aluminum alloy under standardized conditions is given in Table IX, though it must be borne in mind that, as will be seen later, different alloys vary in their suitability to the different anodic treatments.

Standards for corrosion resistance of anodic coatings have been given which often require the film to withstand 250 hours' salt spray (20% NaCl). On pure aluminum, sulphuric acid and oxalic acid films with thicknesses of about 0.0001" to 0.0006" usually fare best and will stand up to salt spray for up to a year. Chromic acid films are thinner (approx. 0.00006") and stand up to salt spray for about one to four months. Films produced by chemical treatments achieve 250 hours only under the best conditions of alloy, form, and treatment, and are used mainly as a paint base.

Under severe service conditions requiring maximum corrosion resistance, alloys are usually painted, and anodic and chemically produced films produce an excellent key to organic finishes. For indoor use, a zinc chromate primer and one finishing coat are usually sufficient protection while, for marine exposures, as many as three finishing coats are often applied over an inhibitive primer and, for corrosion resistance of the highest order, an initial anodized surface might be required. Table X gives the results of some fatigue-strength tests carried out on the wrought duralumin-type alloy 17S-T after exposure. On the whole[67,68] the corrosion testing of coated aluminum alloys is similar to that of the untreated metals, though it is often simpler to obtain visual evidence of penetration of a coating.

Table IX

Tests on Anodic Coatings on a Casting containing Si, 8.5%; Ca 1.4%; Fe 2.4%; Mn 0.02%[65]

Anodic treatment	*Durability under Salt Spray*
None	General whitening and deep attack in one day at many points.
Chromic acid	A few white corrosion spots in 100 days.
a.c.-oxalic acid	A few white corrosion spots in 10 days. At end of 100 days a number of points of attack developed but mainly at edges, corners, holes and casting blemishes.
d.c.-oxalic acid	A few small corrosion patches evident in five days. No further deterioration in 100 days.
Sulphuric acid	Tiny white corrosion spots during first few days. Marked attack at corners and edges in two days and generally rather poor in 20 days.

Special Corrosion Problems

The choice of anodizing and chemical conversion processes depends largely on the alloy used. Different processes are suitable for different alloys, as regards corrosion resistance film thickness, color, suitability for dyeing, etc. The various factors involved will be discussed when the processes as such are considered in detail. Similarly, the choice of alloys and treatments in a wider sense depends upon the service conditions to be encountered.

The alloy's resistance to different corrosive environments depends upon its chemical composition. Apart from the general resistance to corrosion which is influenced by their chemical homogeneity and the local electrical currents which are set up between alloy constituents of different potential, various alloys are particularly resistant to attack by certain chemical compounds. A well-known example of this is the resistance of the aluminum-magnesium alloys to sea water. Most aluminum alloys are extremely susceptible to attack by sodium chloride, tending to produce pits, which in turn accelerate surface corrosion. Some of the aluminum-magnesium alloys[34] are particularly resistant, which may be explained by the idea that the magnesium is anodic to aluminum and is dissolved preferentially with the formation of magnesium chloride as well as sodium hydroxide. The latter, while attacking the aluminum, at the same time precipitates a coat of insoluble magnesium hydroxide, preventing further attack. In the same way, the higher the magnesium content of the aluminum-magnesium alloys, the more does the alloy seem to take on the chemical character of magnesium, causing it to become less soluble in alkalies and rather more susceptible to attack in acid solutions. When containing manganese or antimony, these alloys are stated to be further protected by protective films of manganese- or antimony-oxide which increases their resistance to salt solutions. The theory of the effect of magnesium and the other alloy constituents mentioned is still in question, however.

In marine conditions, therefore, the most commonly

Table X

Comparative Corrosion Resistance of Coatings on 17S-T After Exposure[66]

Treatment	*Fatigue strength (kg. per sq.mm.)*
Untreated	4.5
Anodized, lanolin impregnated	6.5
Cellulose lacquered	7.0
Varnished	9.5
Anodized-cellulose lacquered	12.0
Anodized and lacquered with P.F. resin	15.0

used alloys contain magnesium, with or without the addition of manganese, antimony, chromium, etc. Where high strengths are required, the more corrodible copper- or zinc-containing alloys must be used, which must then be chemically pretreated and painted particularly between contacts with other metals. In practice this is avoided by the application of anti-fouling paints, which must, however, not contain mercury or copper, both of which promote corrosion on aluminum.

Corrosion problems with aircraft and ships were investigated extensively during the last war and many types of attack have to be guarded against. Some aluminum-alloy sheet used in aircraft is employed in the clad form, which protects the alloy both mechanically and by electrochemical action. In addition, most surfaces are anodized and paints are employed on occasion. Corrosion in aircraft may, for instance, occur through battery acid which may be carried over to structural members. Leaking water may also create concentration cells, different concentrations of an electrolyte, such as rain water or sea water, causing corrosion in the lapjoints between sheets of metal. Other corrosion problems result from minute chafing on the surface which destroys the oxide film, with resulting hydrogen evolution.

Apart from protective surface treatments, precautions against corrosion include careful storage of aluminum sheets, where paper must be kept perfectly dry to prevent leaching of the corrosive sodium sulphite, frequent cleaning of degreasing tanks, cleaning of any corroded part with chromate solution to inhibit further attack when painting, and special protective treatments between dissimilar metal contacts where the ratio of the areas of cathodic metal to anodic metal should be as small as possible.

The importance of chafing has also been observed in tropical conditions,[22] which are among the worst encountered. Frequently, the wings of aircraft after service in the tropics appear as if sandblasted. This is mainly due to three causes; viz., salt-water corrosion in which the salt dries on the metal and absorbs new moisture from the air, coral-sand abrasion, and the production of ammonia by micro-organisms present in the atmosphere. which reacts with the aluminum when the film is broken down by abrasion. Hard, abrasion-resistant protective coatings may go some way to protect the metal.

Individual corrosion problems are, however, very numerous, and it has been impossible here to more than touch upon the subject.

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Thermostatic Control in Electroplating

By Leo Walter, *Consulting Engineer, Cheltenham, Eng.*

ELECTROPLATING is, in the first instance, a chemical process initiated and maintained by an electric current. Amongst the factors producing the desired finish is bath temperature and, in the following, simple ways and means will be discussed for correcting bath temperature, which can be automatically maintained in the smallest plant as well as in the large continuous plating system. Similarly, thermostatic control should be applied to metal cleaning and degreasing, and for drying or baking.

A Few Basic Facts

Looking at a plating operation solely from the thermic angle, i.e. leaving aside all chemical and mechanical reactions, the heating of a solution can be performed by a medium which can be steam, hot water, oil or gas, or electric current. Steam or hot water can be used in a heating coil immersed in a plating vessel, either by means of heating coils or in form of a jacket (Fig. 1). Oil or gas burners can be applied to heat the solution, and the main point is to be sure that the heat is adequately distributed (Fig. 2). Electric immersion heaters are often used for smaller plants, and the usual way of regulating the rate of heat input into the bath is to switch the electric current on and off according to the heat demand. The longer the periods of "current-on," the more will the bath temperature rise. Basically, the on/off" method of heat control (Fig. 3) is adequate for medium sized plating vessels where a reasonable temperature fluctuation can be allowed. Where higher accuracy of bath temperature is desirable, gradual or metering control methods should be applied, whereby heat input is gently varied according to heat demand. Either self-actuated proportional temperature regulators can be used, or power-operated controllers may be applied using, as outside source of power, compressed air or water or oil under pressure, or electricity in electric or electronic controls. What is called "sequence control" has to be applied where a cooling cycle follows the heating cycle as, for example, in chromium-plating. Exothermic reactions produce a temperature rise of the bath, so that not only heat input has to be controlled but a cooling medium, usually cold water, has to be admitted into a coil or jacket (Fig. 3A).

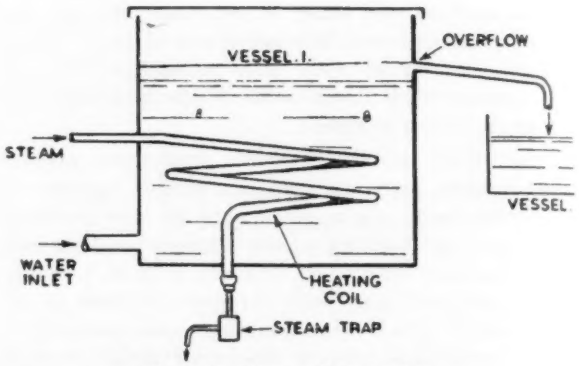


Figure 1. Steam coil for heating.

Time Lags and Temperature Control

The user of plating equipment should be familiar with the control terms of "process time lags" and of "controller time lags," when specifying temperature control equipment for a plant. A clear understanding of time lags will also help to realize why sometimes thermostatic controllers often behave poorly in practice. Explained simply, process time lags in temperature control are retardations and delays of heat flow in a thermostatically controlled vessel, caused by various

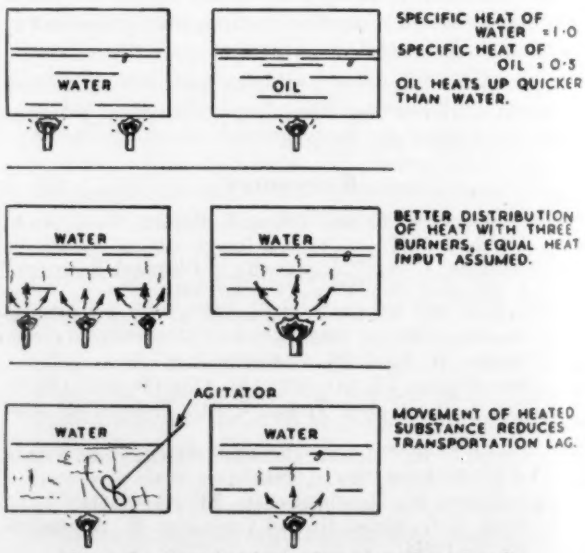


Figure 2. Heat distribution lags of gas-heated tank.

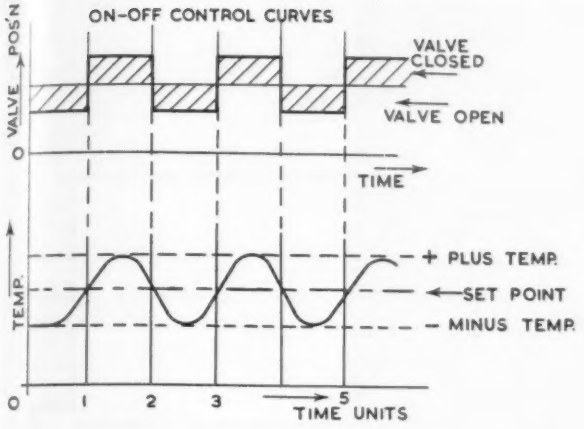


Figure 3. Two stop (on-off) mode of control of heat input into plating bath.

factors, which produce time lags between action of a controlling device and the consequent reaction of bath temperature. For example, looking at Fig. 4, it is shown that plating can be a multi-capacity heat flow process, having, for example, 2 heat transfer surfaces as illustrated. Assuming a quick closing of a steam valve on the heating coil, some time will elapse before this cutting off of heat input will be felt in the plating solution (Fig. 4A). In spite of instantaneous action of a solenoid valve in the steam supply, the temperature may rise all the time until a new heat balance has been established in the bath so the user has to put up with certain unavoidable temperature fluctuations of the bath, caused by time lags in heat distribution, delay in heat penetration, through a heat transfer surface, such as a heating coil wall and the like. Another general point to be realized is that the control instrument has an "instrument time lag" which retards and delays

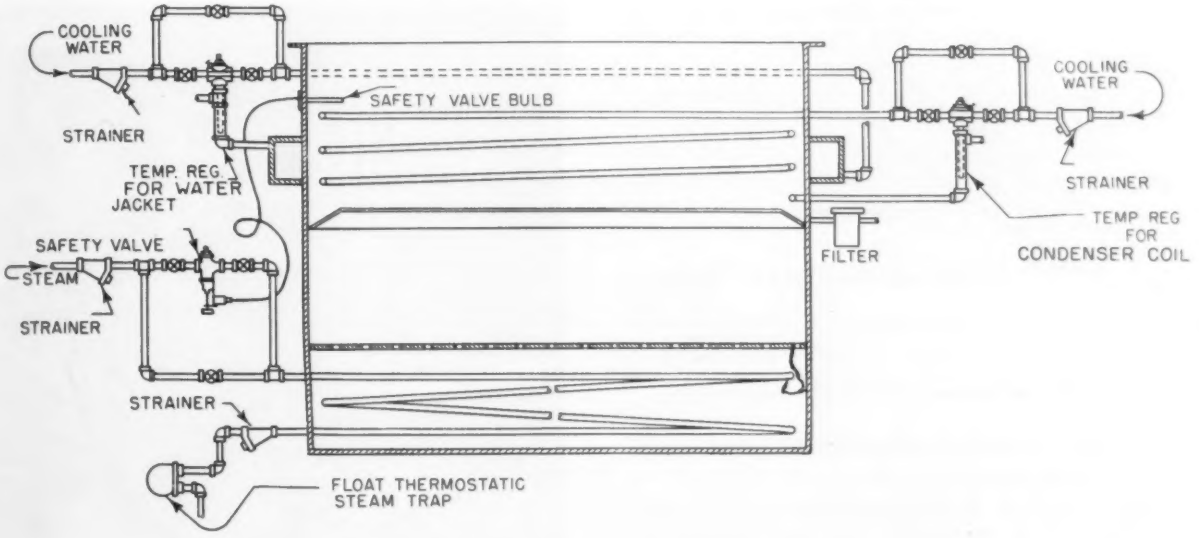


Figure 3A. Installation of controlled heating and cooling for chromium tank.

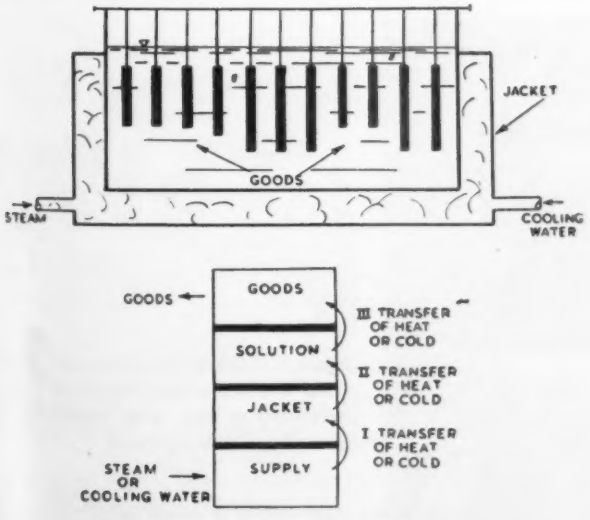


Figure 4. Multi-capacity heat flow process.

detection of a temperature change of the bath, and also causes a delayed operation of a control valve or control switch. Fig. 5 shows, for example, thermometric lag of a thermostat bulb immersed in liquid, depending on various factors. Some temperature controllers have larger time lags between detection of temperature change of the bath and action of the "regulating unit" (control valve or switch), and others react more quickly, i.e. have a small instrument time lag. Electronic instruments act rapidly, but other regulator types act more slowly. This does not mean, however, that a very sensitive and quick acting temperature regulator is always preferable, because it might over-regulate or produce "hunting," i.e. irregulor and sometimes increasing oscillations of the controller mechanism. The user or potential user of thermostatic control should be familiar with the basic ruling of automatic control, which applies to any control system, and application,

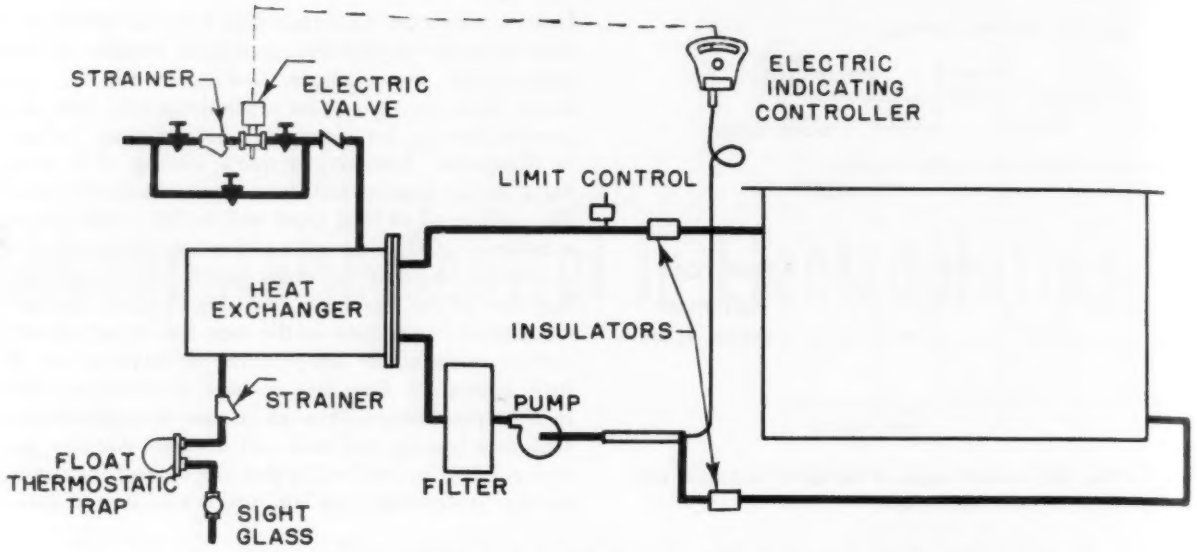


Figure 4A. Hook-up of heat exchanger and plating tank with electric indicating controller and solenoid valve.

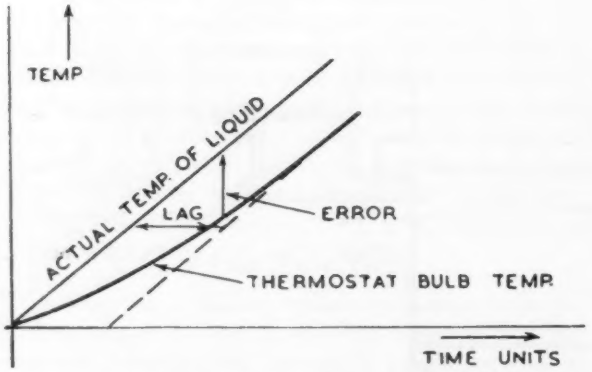


Figure 5. Time lag and error of immersed thermostat bulb.

namely that "controller characteristics must match process characteristics."

In other words, it would be of no use to fit an elaborate electronic or pneumatic reset type regulator of quick response to a process having a "slow reaction rate," when only moderate accuracy of control is required. In this instance, a simple immersion thermostat with solenoid (Fig. 6) will be perfectly satisfac-

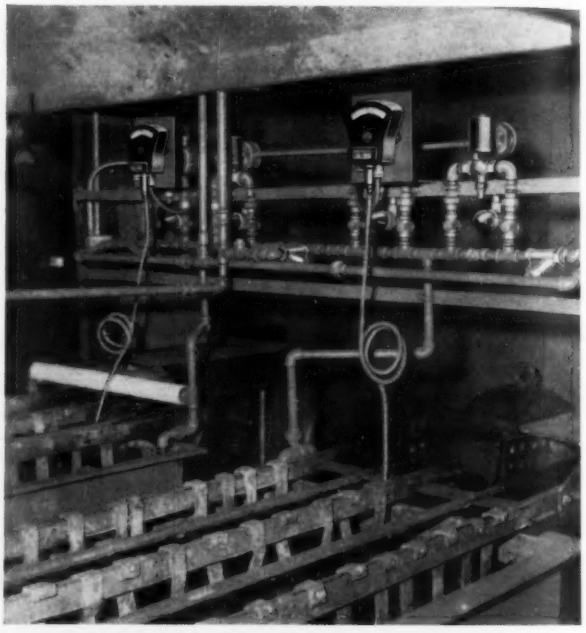


Figure 6. Electric thermostats actuating solenoid valves.

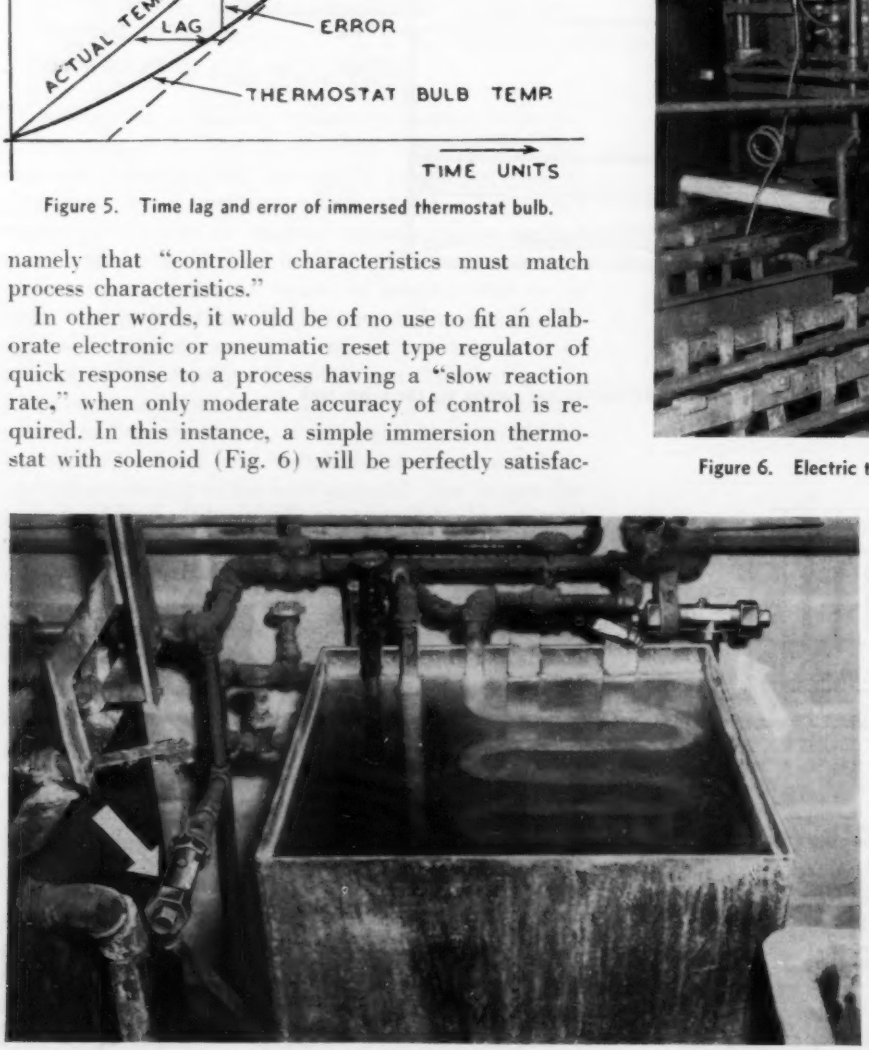


Figure 7. Combined condensate removal with approximate thermostatic control on rinse tank. (Arrows show simple regulators.)

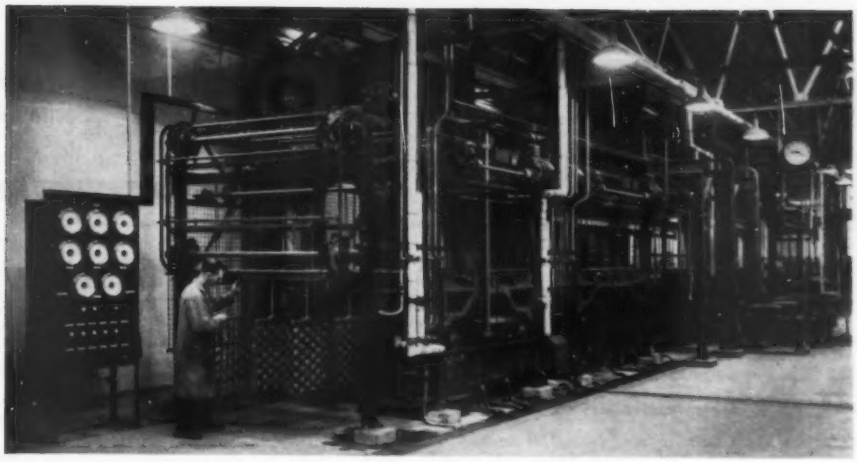


Figure 8. Automatic plating plant with automatic temperature controls.

tory. For similar conditions on rinse tanks, temperature control can be performed from the tail end of the heating coil, as shown in Fig. 7, where outflow temperature of condensate from the heating coil is used to keep solution temperature as desired. If the tank temperature rises unduly, condensate outflow is throttled, and the heating coil is temporarily water-logged, thus bringing the solution temperature down. For larger plating installations, snch as automatic plants similar to the one shown in Fig. 8, process characteristics and demands on accuracy of thermostatic control are so exacting that, to require close temperatures, it is imperative to use quick-acting highly sensitive regulator types, such as electronically or pneumatically operated regulators.

The Process Control Cycle

In order to select the right type of temperature control instrument, a thorough understanding of the general process control cycle is important. Fig. 9 illustrates the control of a heat flow process, as encountered not only in plating control but in innumerable thermostatic control problems. With a temperature change in the process, a chain of actions and reactions is initiated. A detective or primary element (thermostat bulb or resistance thermometer) sends out an impulse to the control mechanism, where its intensity is measured, and transformed into electrical or mechanical action. This latter actuates the regulating unit or secondary control element, which may be a control valve or switch, or control gear of any kind. Action of the latter influences heat input (or heat extraction in case of cooling) of the process, and it is most important to realize that *the controlled process itself is an integral part of the control cycle.* The immersed thermostat bulb or resistance thermometer or thermocouple closes the control cycle. The illustration symbolizes the "closed loop" of the chain of control actions and reactions.

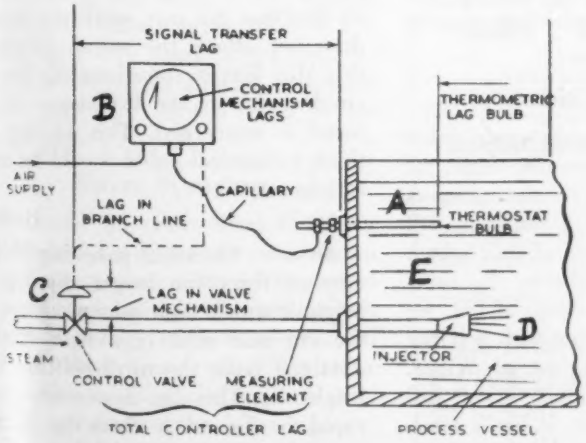


Figure 9. Control cycle of pneumatically controlled direct-heated plating tank. (Note: control cycle is A-B-C-D-E-A)

Correct Choice of Control Method

The foregoing should assist in correct selection of the control method and of regulator types for an existing or a new plating plant. The factors to be considered are:

a) Desirable accuracy of control.
b) Servicing and maintenance.
c) Cost of control equipment.

The desirable "accuracy" or closeness of holding of temperature in a process tank depends on many factors and must be specified from experience. The higher the specified accuracy, the more elaborate becomes the control outfit, although no general ruling can be given, because some vessels are better controllable than others, having better "self-regulation." For example, a very large plating tank can better smooth out temperature fluctuations resulting from additional load (by hanging in new cold metal parts) than a smaller tank. Or, a larger volume of the steam or hot water jacket makes the solution temperature react more quickly to changes of heat input than a small volume jacket.

Under average conditions, the demand for accuracy of solution temperature can be held moderate, so that simple temperature control devices can be installed for smaller plants. Where the cost and nature of the finished product warrants it, closer control can be specified which, in turn, increases the costs as mentioned under (b) and (c). It is advisable to be rather generous in allocation of first installation cost for a temperature control system, because about 1% to 2% of the total cost can produce all the benefits of reliable thermostatic control.

Shop Problems

Abrasive Methods—Surface Treatments—Control
Electroplating—Cleaning—Pickling—Testing

METAL FINISHING publishes, each month, a portion of the inquiries answered as a service to subscribers. If any reader disagrees with the answers or knows of better or more information on the problem discussed, the information will be gratefully received and the sender's name will be kept confidential, if desired.

Cooling Anodizing Baths

Question: We have found it impossible to find information regarding heat generated by a current passing through an electrolyte. The particular problem in which we are interested involves the anodizing of aluminum in a 2-5% chromic acid solution, drawing 1000 amperes at 40 volts. The current density is a variable quantity. If you could give us information regarding this we would indeed be pleased to have your instruction in this matter.

Z. M. F.

Answer: Ordinarily, it is assumed that the power input to the anodizing tank is entirely dissipated in the form of heat. Since the current and voltage requirements will vary during the course of the anodizing cycle, the following procedure should be used for determining cooling requirements.

A watt-hour or energy meter is hooked into the power line and the average kilowatt-hour demand is obtained. Using an overall conversion efficiency of 80%, the average D.C. output is obtained in k.w.h. This, multiplied by 3,413, which is the number of b.t.u. per k.w.h. results in the amount of heat liberated in the tank. A standard ton of refrigeration is 12,000 b.t.u. per hour so that, if a cooling unit is to be employed, the capacity in tons can be calculated.

For example, if the energy meter indicated an average power input of 25 k.w.h. per hour, the D.C. output to the anodizing tank would be 0.80 x 25 or 20 k.w.h. This is equivalent to 20 x 3,413=68,260 b.t.u. per hour. The refrigerating capacity required would then be 68,260÷12,000=5.7 tons.

Stains on Barrel Cadmium Plate

Question: For months we have been having trouble with stains in our barrel cadmium plating. These stains form on the surface immediately after plating on all types of work — flat washers, lock washers, springs, bolts, nuts, etc. All techniques known have been used in rinsing but to no avail. Anodes have been analyzed for purity, the solution has been discarded and built new with the same results, whether with brightener or without. Every other shop we have contacted has the same trouble, so I am sure many readers would be interested in a proven remedy.

L. J. S.

Answer: The most likely cause of the stains on the sample forwarded is insufficient rinsing between operations. The appearance of the cadmium deposit would indicate that your anodes, solution and plating conditions are satisfactory. We would consider the samples to be nicely plated and believe that further improvement will be costly, involving use of rotating cylinders for cleaning, pickling, rinsing and bright dipping.

Wiping Cloths

Question: Our wiping costs prior to lacquering run extremely high. At present we are using washed diapers but find that at times a shipment will contain a small degree of lint, which seems to be uncontrollable. To overcome the cost and problem of lint, we have been experimenting with a paper product, the Scott Industrial Wiper. Whereas the cost is much lower and the lint is non-existent, it has a tendency to scratch if not handled properly. Since our product requires a very delicate operation and perfect finish, the few rejects that come through offset the saving that would be effected.

Can you suggest a paper product or any other inexpensive product that would contain the following requirements:

Great absorbency.
Non-scratching.
No lint.
Wet strength.
Enough strength to hold up when used in chemical solution, such as ethyl acetate.

F. S.

Answer: If you have not already done so, we would suggest that you communicate with the Kimberly-Clark Corp., Neenan, Wisconsin. They may be able to provide you with an industrial wiping tissue which will meet your requirements.

If paper products are not suitable, other materials to be considered are flannel and domet cloth, which is similar to flannel but has a nap on both sides. Washed diapers, in our experience, have shown the least trouble with lint, however.

Chemical Polishing

Question: We would appreciate receiving information on a bath make-up for a chemical polish exclusive for brass. We now use a 4 oz. per gal. chromic acid bright dip solution as we find that this mix, while not strong, does not attack the metal. However, this dip leaves something to be desired as far as the brightness of the metal is concerned. This is why we think a chemical polish would be more satisfactory.

R. M.

Answer: Chemical polishing is just another term for bright dipping. A brighter finish than that produced by the chromic acid type bath can be obtained from the nitric-sulfuric acid bright dip. This dip, however, is more rapid in its attack than the former. Formulas for bright dipping will be found in the latest edition of the

METAL FINISHING Guidebook-Directory.

Passivating Nickel

Question: Please send me information on the electrolytic treatment (passivation) of nickel plated parts to improve the corrosion resistance. I believe there is a patent on this process using sodium dichromate. If possible I would like to know the patent number. In your opinion, does this process have any commercial value?

E. N.

Answer: Electrolytic passivation treatments are commonly used for copper and gold alloys, a solution of about 8 oz./gal. sodium dichromate being satisfactory, either neutral or slightly acid. However, we have no record of this process being used to passivate nickel. Nickel is ordinarily considered sufficiently passive so that no surface treatment is required. Dichromate is used to provide a stripping film on nickel in electroforming.

The dichromate passivation process is in the public domain.

Plating on Beryllium Copper

Question: We encountered a problem concerning silver deposition on electrical contacts made of beryllium copper, which were hardened for springing. The plating flakes off a few. We barrel plate them in the conventional silver strike and in the regular silver plating solution after they are cleaned in alkali cleaner and bright dipped in two parts sulphuric acid to one of nitric, also dipped in 10% sodium cyanide.

H. C. R.

Answer: Blistering and flaking may be due to improper pickling of the metal. Heat treating scale should be removed in warm 10% by volume solution of sulfuric acid. This is followed by a very quick bright dip.

The silver strike should be low in metal and high in free cyanide for barrel plating.

Silver Spraying

Question: In your Metal Finishing Guidebook you give some information on a "mirror-spray method." We would be very much interested in putting this imitation plating method to practical use on slush metal. (lead-antimony composition). However, we are completely ignorant on the following:

Can an ordinary spray-gun be used, or does it have to be specially constructed? What is the chemical makeup of the silver-nitrate solution and what is the reducer solution? With what do you tint the final coat of lacquer to produce various shades of gold? Must the first coat of lacquer be baked on the metal?

D. L.

Answer: A special spray gun is used with two nozzles, one for the silver solution and the other for the reducer. It may be made of plastic or of stainless steel. The formulas for the solutions will be found in the Metal Finishing Guidebook.

Special dyes are used for tinting the lacquers. These dyes are available from the lacquer suppliers. The first lacquer coat need not be baked on the metal for this type of silver coating. The baked lacquer is used only for vacuum metallizing, which is the method commonly employed instead of a spray gun because of the difficulty of obtaining a bright surface with the latter. The spray method is used mainly to form a conductive surface for subsequent electroplating.

Stripping Copper from Solder

Question: Can you suggest an effective and economical stripper for copper plating which will not attack 60-40 tin-lead solder?

E. S. B.

Answer: Strips which will not attack the solder are as follows:

1. Chromic acid — 4 lbs./gal.
   Sulfuric acid — 4 fl. oz./gal.
2. Polysulfide solution — 1 pint/gal.

Any of the polysulfides used for oxidizing copper and brass, and obtainable from plating supply houses, may be employed. After soaking for 3-5 mintes, immerse in a solution of 1 lb./gal. sodium cyanide. Then repeat as often as required, according to the thickness of the copper deposit.

The second procedure is less expensive than the first but involves more manipulation.

ABSTRACTS

Rapid Porous Chromium Plating

D. V. Pletnev and V. N. Brusentsova: *Vestnik Mashinostroeniya.* Vol. 32, No. 2, pp. 37-40.

The authors investigated the most favorable type of porosity with porous chromium plate as obtained with normal current densities. On the basis of this investigation, suitable conditions were evolved for accelerated porous chromium plating at high current densities (up to 150 amp./sq. dm.), by which the same high standard of porosity is achieved. The base material on which the plating tests were conducted was cast iron piston rings and the working temperature of the bath 40° to 60°C. Details are then given covering 4 rapid chromium plating processes which were investigated in detail and information given regarding the quality, thickness of the chromium plate, the porosity standard, and the depth of pores with the 4 processes as well as operating conditions which should be observed with the porous rapid chromium plating process.

The investigations showed that the chromium plating time can be reduced to half if, instead of operating the bath at 50 amp./sq. dm. at 50°C., it is worked at 100 amp./sq. dm. at 50°C. or 150 amp./sq. dm. at 60°C. and that even higher current densities than these figures can be successfully employed.

Mechanical Process for the Production of Porous Chromium Plating

G. S. Samoilovich and N. G. Andreev: *Vestnik Mashinostroeniya.* Vol. 32, No. II. pp. 49-52.

The authors provide information regarding a simple mechanical process for the production of porous chromium plate which requires no special equipment in the chromium plating shop and no narrow, precise control of the temperature and composition of the chromium plating baths and of the current density. The equipment comprises a mechanism for the impression of narrow but relatively deep cavities in the surface to be chromium plated and the equipment is designed so that the supervision of the number, distribution, size and shape of these cavities is rendered easy. Details regarding the roughening process and over all the subsequent operations with machine tools are given and details are provided regarding the test results which were obtained under specially severe conditions on multi-cylinder engines with porous chromium plated surfaces by the above procedure as compared with nitrided surfaces. The usefulness of the process for application to other machine parts than engine cylinders is then discussed. Suitable measurements for the porosity are: Distance of the cavities from one another 2 mm.; depth 0.15 to 0.25 mm.; shape of the four-sided pyramid from 0.3 times a 3 mm. base with diagonal in the running direction of the cylinder. Distance from the end of the cylinder not too small; thickness of the chromium plate 0.07 to 0.08 mm.

Metallographic Studies of Electroplated Chromium

L. Koch and G. Hein: *Metalloberflaeche.* Vol. 7, No. 10, pp. A145-A148.

With the increasing use of hard chromium plate, considerable research has been conducted in recent years on the characteristic properties of the deposit and particularly to obtain information on the structure of the plated chromium metal, i.e. fineness of grain, texture and possible modifications (α, β and γ phases), softening by way of heat treatment or relaxation, the causes of the extreme hardness of

the chromium plate and the influence of water and hydrogen on the metal. Many methods of structural examination are possible; microscopic examination has considerable importance but, by itself, provides no final conclusions as the chromium is extraordinarily difficult to etch and is so fine grained that it is difficult to discern the intimate structure with the optical microscope. As an example, the grain size of chromium plate has been estimated to lie between 10 and 15 x 10^{-7} cm. In the present research the authors studied the formation of the cubic space centered alpha and the hexagonal beta phases of plated chromium.

The deposition conditions were as follows. Composition of electrolyte: 300 g./L. of chromic acid and 3 g./L. of sulfuric acid; current density 40 amp./sq. dm. and bath temperature 50°C. The hard chromium was plated on steel and copper respectively and after etching in hot, concentrated sulfuric acid (1:1) at 80°C. after previous activation in concentrated sulfuric acid (1:3) with zinc dust, the texture examination was conducted at a magnification of 600. No individual crystallites were discerned but only a kind of roughening and individual, fine dark crevices. These were considered as cracks filled with occlusions. In the case of the chromium deposited on copper, a fine striped effect was seen, parallel to the surface of the base metal. After a recrystallization heat treatment of chromium on copper, the cracks had already become visible after the heat treatment in the unetched condition and these cracks were broadened by the etching treatment. Fine, small crystals were now clearly discerned.

Differences in the structure of the chromium as deposited by a rectified single phase current from the normal hard chromium electrolyte, compared with that of chromium deposited by d.c. and multi phase rectified currents, were studied. The attack with the normal etching medium led to development of the structure in one sec. while with normal hard chromium 2 minutes is required. The coatings also had not the brillancy of hard chromium, but appeared matt grey. Unetched sections were examined in polarized light. It is known that only the crystal structure of non-cubic crystallized metals can be recognized unetched in polarized light and here apparently it was a case not of the non-polarizable cubic, space centered alpha phase but apparently of the hexagonal beta phase. It was found that the beta modification is unstable and changes after heating or after prolonged standing at room temperature into a cubic form which is non-polarizable under the microscope. To summarize the knowledge obtained on the structure of plated chromium it can be said that thermally produced chromium is of the cubic, space centered form; electroplated chromium can be obtained in three modifications which are the cubic, space centered alpha chromium; the beta chromium with hexagonal lattice and as gamma chromium with an alpha-manganese type lattice. Mixed crystal types also occur. Alpha chromium is stable while the beta and gamma modifications are not stable.

Chrome Diffusion in Steel — Chromizing Processes

W. Katz; *Werkstoffe und Korrosion:* vol. 4, No. 2, pp. 49-57.

As opposed to chrome plating of steel, the coating formed by the chromizing (Inkromierung) process is of an alloy nature, and comprises a chromium-iron compound. The choice of the most suitable process, i.e. from the gaseous phase or by saltbath treatment for any particular part, will depend upon nature, shape, purpose of application and selling price. Application of the techniques has taken somewhat different aspects in different coun-

tries. In Germany, the development of the Inkromierung process has resulted in development of low carbon special steels which are particularly suitable for chromizing. One of the first applications was the production of chromized milk can containers, which have given very good results in practice. A broad application of the process has been the production of small parts such as bolts, nuts, exhaust tube manifolds, heat exchanger tubes, etc. The French Onera process has been applied on the industrial scale.

The German process employs the gaseous phase. Hydrogen loaded with hydrochloric acid gas is passed after drying in a heated tube, first over ferrochrome and then over the steel parts to be coated. In this way in 6 hours at 980° C. a 0.1 mm. thick chrome coating is obtained.

The core material, by virtue of the treatment, shows grain growth and carbide formation, which is dependent on the composition of the steel, the working temperature, time and cycle of the process. The hardness of the chromized coating increases with the carbon content of the steel and is based on the presence of carbides. The hardness attains a Rockwell of about C-70 and this is particularly desirable for cutting tools such as saws, drills, borers, cutting tools and dies. Chromized steel parts are also capable of being subsequently worked without damaging the chrome coating. The coated parts can be brazed and welded.

The corrosion resistance of the coating corresponds to that of a high alloy ferritic steel and the coating is as resistant to oxidation at the higher temperatures as it is to attack by solutions. Carbide and alpha phase separations in the surface are to be avoided as well as adhering particles of the chromizing mixture if a cementation process is used; these particles must be merchanically removed. Polishing increases the corrosion resistance of the coating.

The producton cost is one of the limiting factors. It is governed by the number and shape of the articles being treated and the possible and necessary finishing operations required (lapping, polishing, etc.) Hollow shapes prevent a full economic utilization of the available furnace space and for this reason it is often of greater advantage to chromize the flat sheet and to shape the article subsequently. For the large scale processing, it is much more efficient to use a tunnel furnace with the ware packed in boxes, as in case hardening practice. A German layout planned on these lines is described in detail. Polishing is performed on stainless steel, and the surface can be electropolished.

PATENTS

Plating Thickness Regulator

U. S. Patent 2,657,177. *Oct.* 27, 1953. *G. H. Rendel, assignor to U. S. Steel Corp.*

Apparatus for controlling the amount of metal electrolytically deposited on an elongated longitudinally moving object comprising a generator for supplying current to said object, a field winding for said generator, means for obtaining a potential proportional to the speed of the object, means for obtaining a potential proportional to the output of said generator, means for comparing the said potentials, an electrical connection between each of the first two means and the comparing means, a potentiometer in one of said electric connections, a first contact arm for said potentiometer, means operable by said comparing means for restoring balance between the said potentials, said last named means including a reversible motor, electric means connecting said motor to said comparing means for operation of said motor in opposite

directions in accordance with the direction of unbalance of the said potentials, a second potentiometer, power leads for connecting said second potentiometer to a source of D.C. power, a third potentiometer connected in parallel with the second potentiometer, a contact arm for each of said second and third potentiometers, means for connecting said motor to one of said second and third contact arms to move the same proportional to movement of said motor, an exciter for said field winding, electrical means connecting said second and third contact arms to said exciter, and means connecting said motor to said first contact arm to move the same proportional to the movement of said motor.

Phosphate Conversion Process

U. S. Patent 2,657,156. *Oct.* 27, 1953. *M. Hyams and A. Nicholson, assignors to Parker Rust-Proof Company.*

A liquid composition for the production of phosphate coatings on ferrous surfaces, said composition consisting of an aqueous solution composed of at least one substance selected from the group consisting of phosphoric acid, ammonium phosphate and the alkali metal phosphates, said phosphate being present in a concentration of from 0.05 to 0.25 molar and at least one reducible compound selected from the group consisting of m-nitrobenzene-sulphonic acid in an amount of .05 per cent to .25 per cent, o-nitrochlorbenzene-p-sulphonic acid in an amount of .5 per cent to 2 per cent, 3-nitrophthalic acid in an amount of .02 per cent to .1 per cent, m-nitrobenzoic acid in an amount of .02 per cent to .1 per cent, and the salts thereof in a concentration equivalent to the concentration of the corresponding acid, said solution containing sufficient alkaline material to produce a pH within the range of 4.2 to 5.8.

Plating on Zinc

U. S. Patent 2,657,176. *Oct.* 27, 1953. *H. Berman and S. Katz, assignors to Conmar Products Corp.*

A method for providing a non-blistering deposit containing a substantial amount of copper upon a metal base selected from the group consisting of a ferrous base and a zinc alloy base, said method comprising plating zinc upon the metal base from a zinc solution containing not more than approximately 0.0025 ounce of lead and cadmium per gallon of solution, and plating a deposit containing a substantial amount of copper upon said zinc deposit.

Acid Inhibitor

U. S. Patent 2,657,217. *Oct.* 27, 1953. *H. E. Morris, assignor to Monsanto Chemical Co.*

The process of preparing composition for inhibiting aqueous mineral acid solutions against corrosiveness to metals which comprises reacting a mixture of approximately equimolecular proportions of a normally liquid aromatic hydrocarbon having attached to the aromatic nucleus at least one alkyl group of at least one to five carbon atoms, thiophene, and a Friedel-Crafts metal halide catalyst by boiling under reflux conditions and hydrolyzing the tar-like complex thus formed.

Electroless Nickel

U. S. Patent 2,658,842. *Nov.* 10, 1953. *G. Gutzeit and E. J. Ramirez, assignors to General American Transporation Corporation.*

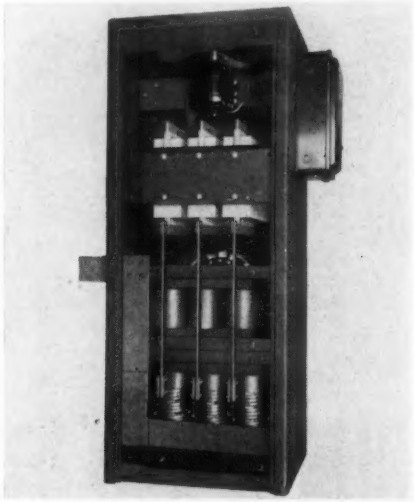
The process of chemically plating with nickel a catalytic material essentially comprising an element selected from the group consisting of copper, silver, gold, aluminum, iron, cobalt, nickel, palladium and platinum, which comprises contacting said material with a bath consisting essentially of an aqueous solution of a nickel salt and a hypophosphite and a salt of a simple short chain saturated aliphatic dicarboxylic acid.

Recent Developments

New Methods, Materials and Equipment for the Metal Finishing Industries

Selenium Rectifiers

Clinton Supply Co., Inc., Dept. MF, 112 So. Clinton St., Chicago 6, Ill.



The above company, which has been associated with the plating field for more than 43 years, has announced a new line of selenium rectifiers. The manufacturer claims that these rectifiers are engineered and built to give long, trouble-free service.

The cabinets are designed for free flow of air throughout, which gives superior cooling, the air intake being from side louvers near the bottom of the cabinet which eliminates foreign matter being drawn off the floor. Cabinets are given multiple coatings of acid-proof primer inside and then finished with an attractive wrinkle finish. The pilot light and controls are on the front panel for convenience in reading and operation.

Transformers used are built to deliver full rated load continuously at a power factor approaching 100%. They are heat-proof, vacuum impregnated, have a conservative KVA rating, and are built to take a continuous overload. Copper pads are brazed to secondary leads, which prevents corrosion or other loss of efficiency.

Stacks are especially tailored for each unit and housed in a steel cradle which is part of the cabinet; this makes them easily accessible to clean and maintain. The stacks are composed of cells of uniform resistance and voltage characteristics.

There are many other features to this line of rectifiers which are described and illustrated in Bulletin No. 4553A. Copies of the bulletin are available by writing to the above address.

Stopping Carry-Over of Chromium Solutions

Magnus Chemical Company, Inc., Dept. MF, South Ave., Garwood, N. J.

The routine treatment of chrome-plated parts usually includes a still, cold rinse directly after plating, followed by a cold running water rinse. After this rinse, many platers use a cold spray rinse, but in almost all shops there is a final hot water soak to provide for self-drying of parts and to act as a security operation to insure complete removal of plating solution. The trouble experienced by many platers was the carry-over of the solution into this final hot rinse tank, in spite of the many rinsings.

The results of an experimental program clearly indicated that Magnus NZ would solve the problem. Subsequent use of this material by many customers in the past few months, as outlined below, has proved that the prevention of carry-over into the final rinse is quite feasible and economical.

The material is used at a concentration of 16 ounces per gallon of water. Following the cold running water rinse of the plated parts, they are rinsed in a cold still tank containing the NZ solution, after which they are given a cold spray rinse. The work is now ready for the final hot soak. No further trouble with carry-over has been experienced by any of the shops using the product which is a special concentrated wetting agent whose solutions have a pH of around 7, and is one of the most effective wetting agents available.

Acid-Proof Pour-Lay Concrete

Sauereisen Cements Co., Dept. MF, Pittsburgh, Pa.

The above manufacturer has developed a new acid-proof pour-lay concrete for industrial use. Known as Sauereisen No. 54, the new concrete is resistant to all acids except hydrofluoric, water, steam, oil, solvents, electricity, and temperatures up to 2,000°F.

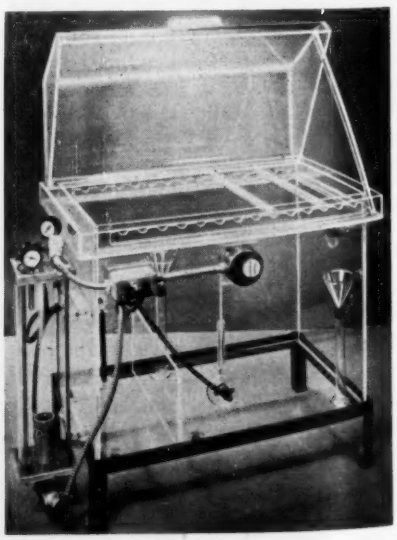
The cement is ideal for use in chemical plants and similar places where corrosive factors are at work. It is highly recommended for use in the construction of floors, sewers, tanks, chimneys, pumps, lining, drains, vats, foundations, towers, etc.

The new concrete may be poured into place and leveled off as desired. It is quick setting, and is ready for use in 24 to 48 hours. No. 54 consists of a dry filler and special liquid binder; when the two parts are mixed together the concrete mix is ready to use and offers greater strength than ordinary concrete mixtures.

Salt Spray Test Cabinet

The G. S. Equipment Co., Dept. MF, 5317 St. Clair Ave., Cleveland 3, O.

Test results within 10% of absolute



duplication is the claim for the new, improved Singleton "H-T Sincolite" salt spray test cabinet introduced recently. It is said to meet A.S.T.M. Specification B-117-49T and the intent of other Government specifications for similar equipment.

Its high degree of uniform accuracy is stated to be due to having no parts of contaminating materials susceptible to corrosion exposed to test solutions or vapors. All gauges and other metal parts are on the outside. The cabinet is the only one of its kind made of a plastic which is non-porous, inert to test solutions, and prevents secondary galvanic acceleration of corrosion. An ideal insulator, it assures proper regulated temperature in cabinet.

Completely transparent, the cabinet affords clear visibility for observing and controlling progress of tests, and examining specimens from all sides without opening lid. Fusion-welded construction provides permanent no-leak seams, and the manufacturer claims that complete elimination of deterioration and maintenance extends service life indefinitely.

Bulletin T-CAB102, reelased by the company, contains complete details and is available on request.

Selenium Rectifier

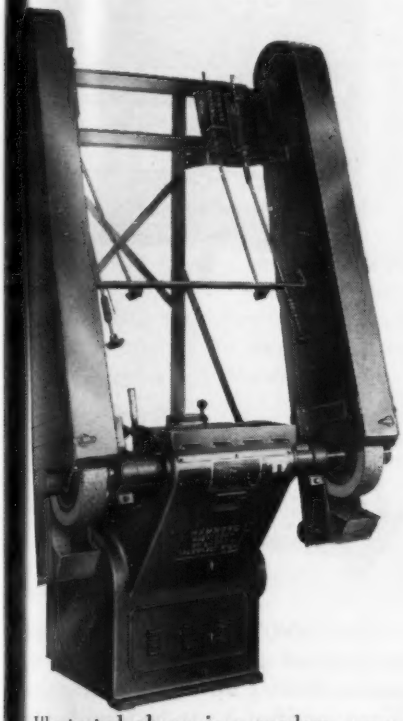
Kocour Company, Dept. MF, 4802 S. St. Louis Ave., Chicago 32, Ill.

The Model 5B selenium rectifier is a self contained power supply, designed to meet exacting requirements, unusual for its dependable accuracy and long life. AC input, 115 volts, 60 cycles: DC output 0-6/12 volts at 5 amperes continuous duty ratings. Full wave bridge type selenium rectifier stack. Powerstat control over entire range from 0 to maximum. Smooth DC output with less than 5% ripple due to choke input filtering. This highly refined unit will fit low DC current requirements.

Further information may be obtained by writing to the above address.

Grinder-Polisher

Hammond Machinery Builders, Inc., Dept. MF, 1601 Douglas Ave., Kalamazoo, Mich.



Illustrated above is a modern, compact and space-saving grinder-polisher using abrasive belts.

The mounting structure is attached to the base of the polishing lathe to which the backstands are mounted — instead of the more conventional method of mounting the backstands in back of the lathe. Abrasive belts up to 14′ long can be used.

The polishing lathe is the Model VRO variable speed (1500 to 3000 RPM) and the backstands can be either spring or air-tensioned models. The same arrangement can be furnished with most Hammond polishing lathes.

Chromate Reducer for Alkali Cleaners

Enthone, Inc., Dept. MF, 442 Elm Street, New Haven, Conn.

The above manufacturer announces a new product called "Chromekill 4A" for destruction of hexavalent chromium in alkaline cleaning and plating solutions. If alkaline cleaners or plating solutions become contaminated with chromic acid or chromates, serious difficulty is usually experienced in the plating cycle. These difficulties include dull plate, poor throwing power, or no plate at all, blistering and peeling. As little as 0.005 oz./gal. of hexavalent chromium will cause trouble.

Chromic acid contamination of alkaline cleaners can occur in many ways. It can come from exhaust systems when the cleaner and chromium plating solutions are exhausted with the same duct system. It can also occur from the use of the same plating racks or fixtures for chromium plating as well as for cleaning and plating operations. Contamination from conversion coating processes can also cause hexavalent chromium contamination of alkaline materials.

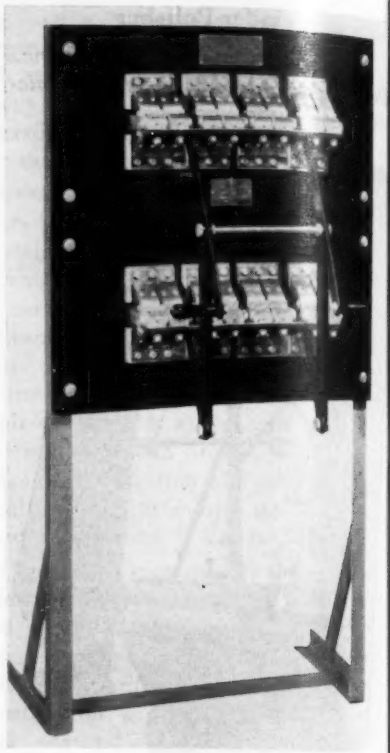
The new product was designed to give a dual action. It contains materials for fast reduction of hexavalent chromium to the harmless trivalent chromium state, and it also contains more stable reducing agents to give prolonged protection. The material is available as a fine free-flowing powdered mixture and is used in concentrations of the order of ¼ oz./gal.

A test solution for determining the presence of hexavalent chromium in alkali cleaners as well as plating solutions is available to customers of Enthone.

3,000 Ampere Reversing Switch

Columbia Electric Mfg. Co., Dept. MF, 4519 Hamilton Ave., Cleveland 14, Ohio.

A new heavy duty double pole, double throw switch for reversing high currents at low voltage has been announced. It is rated 3000 amperes and is the latest addition to an existing line of revershing switches rated 300, 500, 1000 and 2000 amperes for use on direct current up to 15 volts.



This "3000" ampere cam type switch is designed primarily to reverse the current flowing through a plating tank. When specified it can be furnished for use as a series-parallel switch for double commutator generators. The unit consists of two ebony asbestos panels mounted on angle iron supports, with manually operated handle of sufficient leverage for ease of operating the entire switch mechanism. By placing the handle in a neutral position the line current can be disconnected.

A total of sixteen heavy duty toggle-switches are mounted on the panels, eight for each current direction. The cam action of the switch mechanism assures positive contact pressure. Contact surfaces are automatically cleaned by the inherent wiping action of the laminated copper moving contacts. Switch is rear connected, and is furnished complete with reversing jumpers and four terminals for incoming bus bars. Stationary contacts are readily replaceable.

Skid-Proof, Corrosion Resistant Floor Coating

Corrosion Engineering Products Dept., Pennsylvania Salt Mfg. Co., Dept. MF, 1,000 Widener Bldg., Philadelphia 7, Pa.

NeoFloor is a new, economical and easily applied skid-proof surface coating for concrete, wood and metal floors. Developed by the company for

use in plants, shops and other places where oils, greases and chemicals create safety hazards and maintenance problems, it provides safe, comfortable footing and long lasting surfaces which stand up under heavy traffic, heat-aging and other rugged conditions.

The product is a grit-like material anchored in a matrix of resilient Neoprene and bonded firmly to the floor with an adhesive primer. Both primer and coating are supplied in liquid form for easy, quick-drying application with brush or roller.

Unlike ordinary surface coatings, the new material is tough, tightly bonded and highly resistant to fumes, spillage from acids, alkalies, salt solutions and solvents at temperatures up to 220°F. Also waterproof, it is impervious to oils and greases and is easily cleaned with commercial detergents and cleaners.

The floor coating is the company's latest addition to an extensive line of chemical resistant cement mortars, coatings, membrane and molding products and will be distributed through sales engineers in the United States and Canada. Export sales will be directed by Pennsalt International Corp.

Stainless Steel Filter

Steadfast Industries, Inc., Dept. MF, 4731 West Madison St., Chicago 44, Ill.

The above company announces a new type of permanent stainless steel filter for purifying plating solutions. Tubular filter elements made of stainless steel are locked on a single support plate. This allows all of the filter elements to be removed as one unit for inspection and cleaning. The permanent filters also can be "backwashed" periodically for cleaning if desired.

The stainless steel filter elements do not absorb and can therefore be used on either acid or alkaline solutions without fear of contamination.

Aluminum and Steel Cleaner

Oakite Products, Inc., Dept. MF, 154C Rector St., New York 6, N. Y.

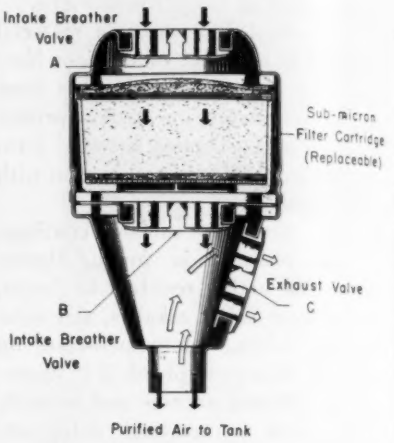
The above manufacturers of specialized cleaning and allied materials, have announced the development of Oakite Composition No. 161, an alkaline-type material designed to clean aluminum, steel and other metals in pressure-spray washing machines without objectionable foaming.

Composition No. 161, the manufacturers state, is a white, free-flowing, powdered material that is completely soluble in water, free rinsing, and inhibited to provide safety to aluminum. Due to its built-in anti-foam properties, this material is also effective in the new, high-pressure-spray washing machines for cleaning steel and other metals, it is claimed.

Recommended for all pressure washing machine applications in the concentration of ½ to 2 ounces per gallon, at temperatures ranging from 160° to 185°F., the material is simply added to warm water, then heated to operating temperature. No boiling-in is required. In extensive field tests carried out in spray washing machines operating at both low and high pressures, the manufacturers report, this material has consistently demonstrated the ability to eliminate the troublesome foaming problems formerly encountered.

Vent for Distilled Water Storage Tanks

Barnstead Still & Sterilizer Co., Dept. MF, Lanesville Terrace, Forest Hills, Boston 31, Mass.



The illustration shows how the new Ventgard filter breathes pure air into distilled water storage tank. Airflow sequence is indicated by arrow — solid arrows for intake, outline arrows for exhaust. When water level in tank is lowered, ordinarily room-air enters through intake valve (A). It then passes through the submicron filter cartridge where particulate matter is removed and where special chemicals absorb gaseous impurities. Finally, the purified air enters the tank through valve (B). When water level is increased, intake breather valves (A) and (B) automatically seal, expelling air through exhaust valve (C). When there is no change in the water level, all valves remain closed, thus protecting both the cartridge and the water in the tank from contamination.

The filter element is a replaceable cartridge containing a new and exclusive combination of pre-filter, purifying chemicals and after-filter. Chamber is of copper, carefully coated with pure tin on the interior. Exterior finish is attractive polished nickel plate. The Ventgard can be used with metal distilled water storage tanks and with Pyrex tanks.

Rinse Tanks for Liquid Blasted Parts

Vapor Blast Mfg. Co., Dept. MF, 3025 W. Atkinson Ave., Milwaukee, Wis.

For the cleaning of small parts after they have been vapor blasted or liquid honed, the manufacturer has available a two compartment rinse tank. The entire tank, inside and out,

is hot dipped galvanized. One compartment is a hot solution tank with a thermostatical control on the shielded heating element and the other compartment is a cold solution rinse.

These rinse tanks are small and compact, easy to use and on one frame. Made of heavy welded steel construction, they have a small shelf on the back of each of the compartments where the parts that have been processed after vapor blasting can be set to dry.

Universal Backstand Idler

Coated Products Division, The Carborundum Co., Dept. MF, Niagara Falls, N. Y.

The "61" Universal Backstand Idler, a new, low cost, attachment for all types of wall, bench and floor, coated abrasive backstand grinding and polishing operations, has recently been announced.

Designed for heavy-duty production grinding, as well as for intermittent light polishing jobs which call for frequent setup changes, the new backstand idler permits belts of the same length to be employed with contact wheels of various diameters.

Varying widths of belts can be used, ranging from ½ to 8 in., due to a patented belt tracking mechanism and highly sensitive tension adjustments. The tracking device eliminates the need for precise center alignment between idler pulley and contact wheel, thus minimizing downtime during contact wheel change-overs. A linkage-

type arrangement permits finger-tip manual adjustment of tension and tracking.

The idler is available in two models —Model 432 for floorstand operations, and Model 431, a smaller, more com-

pact unit, for floor, wall or bench installation. List price for Model 432 is $76, and for Model 431 is $61. The price includes front tracking and tension controls.

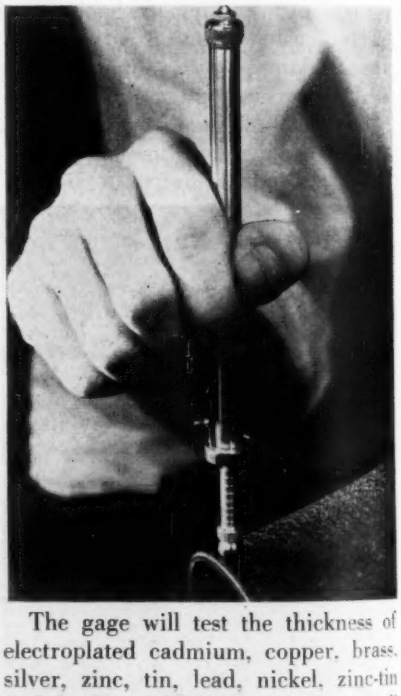
Each model is available as an individual unit or as part of a complete packaged backstand installation which comes complete with the company's specially serrated "T61" contact wheel.

The new backstand idler is being marketed by the Coated Products Division direct and through the company's nationwide sales and distributor organization.

Coating Thickness Tester

Platers Research Corp., Dept. MF, 59 East Fourth St., New York 3, N. Y.

The above firm has introduced a new production tool for metal finishers in the form of a thickness tester called the Pocket Handi-Gage, a magnetic instrument similar in size and shape to the familiar automobile tire gauge. When the magnetic end of the gage is applied vertically to the surface to be tested and slowly pulled away, a calibrated inner stem appears. The distance the stem travels before the magnet releases itself from the surface is a measure of the thickness of the coating.



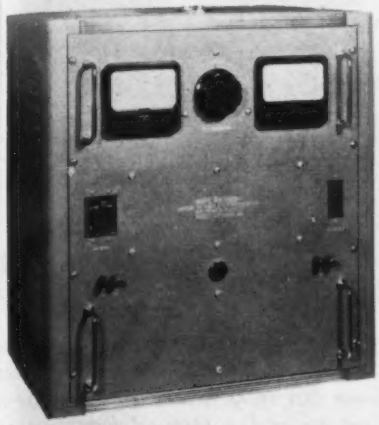
The gage will test the thickness of electroplated cadmium, copper, brass, silver, zinc, tin, lead, nickel, zinc-tin and lead-tin alloys on steel, as well as hot-dipped tin and zinc. It is ideal for testing the thickness of paint, plastic lamination, enamel and lacquer coatings on steel. It will test thickness from 0.0001 inch to 0.015 inch.

The Handi-Gage comes in a de-luxe

pocket size case, which weighs less than six ounces with the gage and extra magnets for various thickness ranges. It is a perfect tool for use on the production line, in the laboratory, or any other place where thicknesses are to be controlled. It may be used as a Go, No-Go thickness gauge at spray booths or plating tanks. The instrument is available for immediate delivery at $75.00 postpaid.

30 Ampere Rectifier

Perkin Engineering Corp., Dept. MF, 345 Kansas St., El Segundo, Cal.



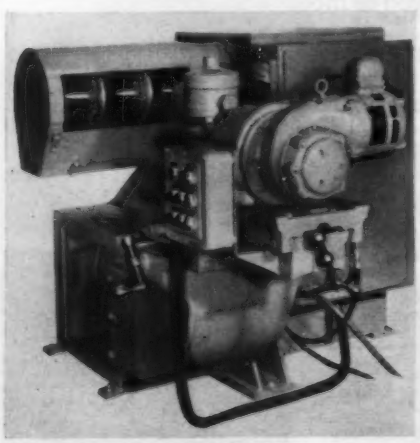
A new 30 ampere power supply has been added to the above firm's standard line of magnetic amplifier regulated power supplies. This new unit, identified as Model No. MR1040-30, is rated at 10-40 volts at 30 amperes continuously and has a regulation accuracy at ±1% (a) from 10-40 volts DC, (b) from 100-130 volts AC, (c) from 3-30 amperes. Its ripple is 1% rms and it is designed to receive an AC input of 100-130 volts, single phase, 60 cycles. It has a response time of 0.2 sec. maximum and the response is independent of the output voltage setting. It is also provided with a 4½" ammeter and voltmeter, weighs approximately 175 lbs. and has the dimensions of 22" wide x 15" deep x 23" high. The unit contains no tubes and utilizes types of magnetic materials plus low leakage selenium rectifier stacks.

Power Brushing Machine

Osborn Mfg. Co., Dept. MF, 5401 Hamilton Ave., Cleveland 14, Ohio.

New power brushing methods for removing burrs and blending surface junctures and doing other brush finishing jobs on large and heavy work pieces have been developed by the com-

pany. The newest development, the Brushmatic 4-L3 machine, was recently added to the line to handle metallic or non-metallic components up to 100 pounds in weight. Rugged in design,



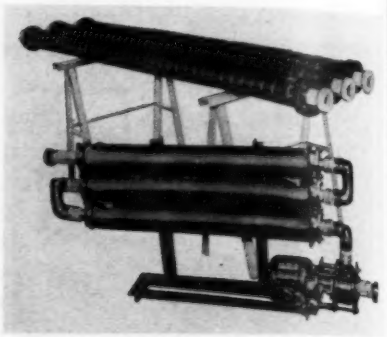
the workholder is integral with the brushing lathe, thus providing a fixed relation between brush and work to be brushed which can always be depended on.

The new machine takes the time-consuming hand work out of removing burrs and finishing unhandily large parts of lesser size than would require the Brushamatic 5. The operation of the brushing machine is so easily learned that an unskilled operator can attain high quality, rapid production quickly.

On the 4-L3 machine, the job of the operator is placing the work piece on the work holding fixture. Once this is done, his job is complete until the work is brushed and ready to be removed. The brushed work is removed, another unfinished work piece placed on the work holding fixture, and so on. A preset timer retracts the brushing heads and motion is stopped until again actuated by the operator. The amount, direction and quality of brushing each object receives, depends on the type, metal, surface desired. The operator simply loads and unloads, all other operations can be pre-determined and pre-set.

Heat Exchangers

Carl Buck & Associates, Dept. MF, P. O. Box 267, Essex Fells, N. J.



Camac units suitable for heating or cooling all plating and pickling solutions can be provided in exact size to heat or cool a tank of any capacity. Materials of construction are varied depending on the composition of the individual solution. For example, Karbate tubes and a Furfural carbon pump are used for all the acid plating solutions except chromic.

For chrome plating and the cyanide solutions steel exchanger tubes and an all steel pump are employed, and for nitric-hydrofluoric stainless pickling solutions a special plastic pump and Karbate exchanger tubes. Standard tubes (Karbate) and Furfural carbon pump are suitable for the fluoborate and sulfamate solutions which have been difficult solutions to control in other equipment.

All units can be used for initial heat-up and subsequent cooling without any danger of damage due to thermal shock. All parts of the units have been designed for this pickling and plating service and have been proven to give long and trouble free service.

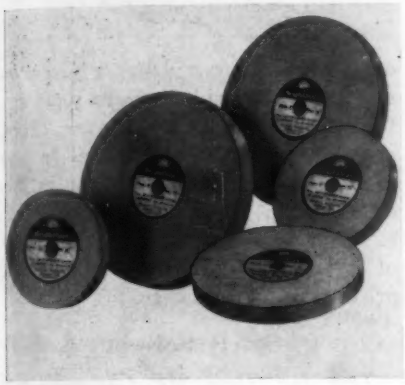
Silicon Carbide Rubber Cushioned Abrasives

Brightboy Industrial Div., Weldon Roberts Rubber Co., Dept. MF, Sixth Ave. and North 13th St., Newark 7, N. J.

A new series of rubber-cushioned

abrasives compounded with silicon carbide has just been announced.

Brightboy abrasives will continue to be manufactured in compound with aluminum oxide, since the demand for this type of abrasive cushioned in rubber has shown a substantial increase. Both the aluminum oxide and silicon carbide types are now being manufactured in an extensive variety of abrasive grain sizes ranging from extra coarse to extra fine. Compounded either with silicon carbide or aluminum oxide, they are made in wheels, discs, sticks, rods, cylinders, tablets and



blocks for a wide range of machine and manual operations. In either aluminum oxide or silicon carbide they feature rubber binders carefully compounded with abrasive grain, to achieve a resilient rubber cushion for the evenly blended abrasive.

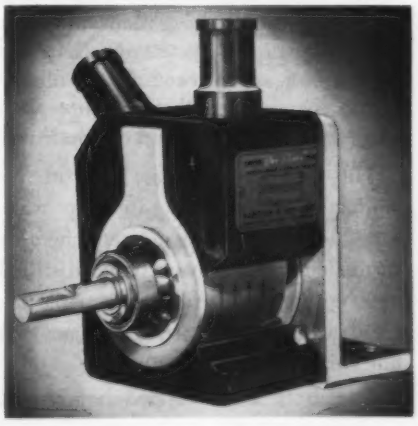
Unplasticized Rigid PVC Pumps

Vanton Pump & Equipment Corp., Dept. MF, Empire State Building, New York 1, N. Y.

The availability of a new "V" Series of flex-i-liner pumps incorporating the use of unplasticized rigid polyvinyl chloride for the pump block has been announced by the manufacturer.

The unusual properties of PVC, particularly its relative inertness to chemical attack, makes it ideally suited for use as a pump housing. At ordinary temperatures it is unaffected by most acids, alkalies, salts, oxidizing agents, oils, greases, and alcohols. In addition to its excellent chemical resistance, PVC is tasteless and odorless and generally physiologically inert. Since this rigid PVC is processed without plasticizers, the full utilization of the chemical inertness and inherent strength, lightweight, and toughness of the straight polyvinyl chloride resins is employed. As compared to other thermoplastic materials, PVC not only exhibits higher tensile and compressive strength, but also has greater stability and hardness, and does not flow as readily at elevated temperatures.

These pumps are self-priming and do not contain stuffing boxes or shaft seals of any sort. Their unique design restricts the fluid to contact with the inner surface of the PVC block and the outer surface of the flex-i-liner which is also available in vinyl chloride. The activating element is an eccentric shaft and rotor assembly which rotates inside the flex-i-liner. Molded flanges on the flex-i-liner straddle the body block and are pressed to its sides by end plates completely sealing off the fluid passage.



Other body block materials of construction available are bakelite, polyethylene, lucite, Buna N hard rubber, and stainless steel. Flex-i-liners are available in natural or pure gum rubber, neoprene, Buna N, hycar, silicone, and compar. Capacities from 1/3 to 20 gpm are attained with pressures up to 60 psi and vacuum to 26" Hg. Recommendations for specific applications will be furnished on request as well as applicable literature.

Small Deionizer

Central Scientific Co., Dept. MF, 1700 West Irving Park Road, Chicago, Ill.

A new device for rapidly changing ordinary tap water into the chemical equivalent of triple distilled water (in terms of specific resistance) for as little as ten cents a gallon is announced.

The new device, called Quikpure, is comprised of a 16-ounce polyethylene squeeze bottle the bottom of which contains a mixture of cation and anion exchange resins. Tap water poured into the bottle comes into immediate contact with the resins and is converted to distilled water in about one minute.

A specially designed cap permits the user to discharge the distilled water from the squeeze bottle, but will not allow the resins to escape. They remain in the bottle and may be used repeatedly up to about 25 gallons of water, depending upon its hardness. When the resins cease to react, a color change occurs caused by the presence of a registered food, drug and cosmetic dye.

The user can regulate the time of contact between resin and tap water until he obtains the desired chemical equivalent of single or triple distilled, or even higher. Higher than triple distilled water is obtained by longer than one minute contact.

The unit holds approximately 12

ounces per filling and has a minimum guaranteed 70 grains removal capacity. It is listed as catalog number 12837 and sells for $2.50 per bottle. In lots of 12, the price is $2.25 each; in lots of 36, $2.13 each; and in lots of 72, $2.00 each. Refills come in packages of 3 with a replacement bottle cap, price $4.50 per package.

Safety Solvent

Tect, Inc., Dept. MF, Cortlandt and Erie Sts., Dumont, N. J.

Vythene, a new, low-toxicity safety solvent only 1/20 as toxic as carbon tetrachloride was announced recently.

The solvent is non-inflammable, fast evaporating and suitable for a tremendous variety of industrial uses and cleaning purposes. It is a stabilized 1, 1, 1, trichloroethane on which the company has a U. S. patent pending.

1, 1, 1, trichloroethane was rated in 1953 by the American Conference of Governmental Industrial Hygienists as 1/20 as toxic as carbon tetrachloride, a commonly used solvent which has been responsible for many deaths and serious injuries.

Showing excellent stability for all metals including aluminum, brass and copper — even at the boiling point, the solvent is non-corrosive to brass and copper and practically inert to ordinary electrical insulating varnishes and materials.

It has approximately the same evaporation rate as carbon tetrachloride but concentrations of the solvent in the air 20 times greater can be tolerated. It is a clean, colorless liquid with a pleasant odor and a very low percentage of non-volatile material.

The solvent is now available in substantial quantities from five different shipping points in the United States.

Solvent Degreaser

Circo Equipment Co., Dept. MF, 120 Central Ave., Clark Township (Rahway), N. J.

Water condensation and resultant hydrolysis will no longer take place along the sides of this degreaser, causing them to rust. Water condensing on the coils will drop into the condensate pan and then into the water separator.

The water temperature regulator is placed after the cooling coil and before the water jacket. This permits accurate control of water in the coil plus insuring the water entering the water jacket at 90°-120°. Water colder than 90° in the water jacket will cause water condensation resulting in hydrolysis, rusting and acid solvent.

Circo's new pump has performance, corrosion resistance, longevity and nonleaking qualities. All pumping parts are fabricated of stainless steel. The rotor and end plates are nickel clad. 90% of centrifugal pump troubles arise from the need of a drive shaft, stuffing box or rotary seals, coupling drive sheaves, V-belts. The new pump uses a rotating magnetic field to drive the impellor and is completely free from these problems. The pump is completely sealed except the intake and outlet, so no leaking is possible. Exceptionally light in weight and almost noiseless in operation.

The storage tank is placed at the end of the degreaser and is an integral part of the tank body. Condensing coils are recessed and placed directly over this storage tank, thereby removing obstructions on the sidewalls of the degreaser. There is no necessity in this new design for separate pump chamber compartment. To distill all the solvent out of the sump, the valve in the overflow line is closed and the storage tank holds the entire contents. After cleaning simply open the overflow valve and solvent returns to the degreaser sump, leaving the required amount for pump storage.

The condensate coils are one piece spiral copper tubing. The exterior is nickel plated for exterior resistance to degreasing solvents and hydrolysis, whereas the interior is superior to galvanized pipe for water transport.

Gas degreasers are equipped with immersion burners instead of pipe burners under the bottom. This lowers the height of the degreaser. Immersion burners are 50% more efficient, thereby reducing gas consumption for any given work load.

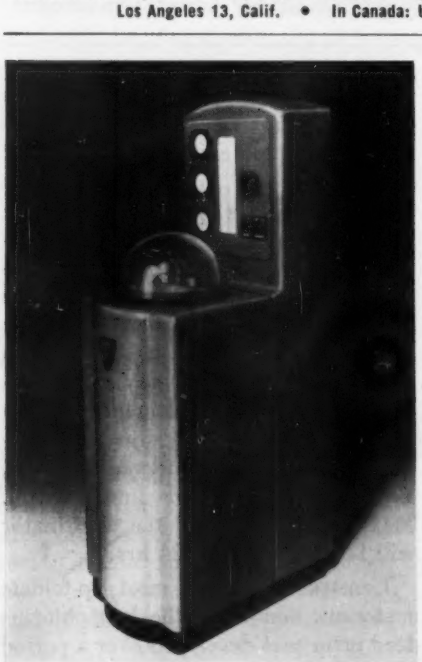
Chlorinator

Wallace & Tiernan Inc., Dept. MF, 25 Main St., Belleville 9, N. J.

Just announced is a new chlorinator, the A-701, which will be introduced at the American Water Works Association Convention in Seattle on May 23rd.

First of a series that incorporates the latest developments of practical chlorinator design, the new device will feature such improvements as dual orifice meter which automatically, or by the flip of a switch, allows feed ranges up to 100 to 1; corrosion resistant materials wherever good structural design permits; linear scale reading of chlorine flow rate; and automatic electric, hydraulic, air or vacuum control. Maximum capacity of the chlorinator will be 1000 lbs. per 24 hrs.

Constructed of the most up-to-date materials, and using the best chlorine feed principles developed over a period



of years, the new chlorinator employs a heavy fiberglass pedestal and an improved design of the W&T glass-enclosed visible—vacuum and water—diaphragm principle of feed control.

Constant Voltage Selenium Rectifier

Richardson-Allen Corp., Dept. MF, 39-15 Main St., Flushing, N. Y.

This new rectifier is rated at 28 volts 30 amperes and is adjustable from 21.8 to 30.8 volts. An electronically-controlled saturable-core reactor is employed to obtain fast recovery and close regulation. Recovery time is 0.2 seconds and regulation of 0.2% with a fixed load and variable line of ± 10% or a fixed line and variable load of 3 to 30 amperes; for no load the regulation will be slightly higher. The output is filtered for a maximum of ½ of 1% ripple. The unit is designed to be operated from a line source of 115 volts, single phase, 50-60 cycles. Ambient temperature range is from —20° C. to +35°C. Manufacturer will be glad to send full information.

BUSINESS ITEMS

H. N. Hartwell & Son, Inc., Appoints New Distributors

Boltaron polyvinyl chloride products are now available to the Canadian market for industrial use wherever corrosion and rough treatment are problems. *H. N. Hartwell & Son, Inc.*, Boston, Mass., announces two newly established distributors: the *Vibra-Lite, (Quebec) Reg'd*, Montreal, and the *A & A Distributors, Ltd.*, Vancouver, B. C. Additional outlets will be added in the near future. The company distributes a complete line of P. V. C. pipe fittings, pipe, sheet, rod, and block stock through ten fabricators-distributors in the United States.

Norton Co. Appoints O'Neil

Russell J. O'Neil has been appointed a field engineer by *Norton Company* of Worcester, Mass., effective April 1. He will be assigned to the Detroit district office.

Mr. O'Neil has been with the firm since 1945. He was formerly a group leader at the Detroit office from 1947 to 1951 when he became a supervisor at the Cleveland office. Since August, 1953, he has been taking the sales training course.

A native of Canada, he served five years in the Royal Canadian Air Force

Russell J. O'Neil

during World War II, being released from service as a warrant officer.

Pennsalt Appoints McCulloch

Joseph S. McCulloch has been appointed manufacturer's representative for the *Pennsylvania Salt Mfg. Co.'s* Corrosion Engineering Products Department, *Robert R. Pierce*, manager, announced recently.

A graduate of Princeton University, Mr. McCulloch is well known in the corrosion engineering field in which he has had more than twelve years of technical and sales experience.

In his new assignment McCulloch will represent the company as sales engineer for chemical-proof cements, acid-proof mortars, chemical-resistant membranes, and corrosion-resistant coatings. His territory will cover Maryland, Delaware, Eastern Pennsylvania and Southern New Jersey.

Mr. McCulloch lives with his wife, Eleanor, and their three children on Rider Avenue, in Riderwood, Maryland.

Nelson Promoted by International Rectifier Corp.

Allen S. Nelson has been appointed manager of the distributor sales at *International Rectifier Corp.* of El Segundo, Calif. Mr. Nelson received his formal technical education at the California Institute of Technology and his business administration education at Roosevelt College. Having previously been employed in the general sales department of the company, Mr. Nelson is thoroughly familiar with rectifier design and application as well as with the sales problems with this particular industry.

Having been employed in the Admiral Corp.'s national parts division for four years and more recently as parts department manager of their Los Angeles distributor, he is thoroughly familiar with all of the facets of electronic parts and accessory distribution.

New Officers Elected by Green Electric

W. Green Electric Co. announces the election of *S. W. Berman* to the position of vice-president and *J. D. Trehy* to the position of treasurer. Purchasing has been taken over by *J. McGee* and *L. W. Reinken* continues as president. The changes followed the resignation of *E. I. Huppert, Jr.*, who has purchased the Sal-Hyde chemical department of Green Electric and is organizing this as a separate business.

All of the men mentioned have been

S. W. Berman

J. D. Trehy

with Green Electric since before World War II. The company, founded in 1892, is best known in the electroplating field for its introduction of the selenium rectifier in this field about fifteen years ago.

Cowles Appoints Pynchon

Cowles Chemical Co., Cleveland, Ohio, recently announced the appointment of *Richard N. Pynchon* to the position of advertising and sales promotion manager. Mr. Pynchon replaces *Elmer A. Lord*, who will remain with the firm as a sales representative in the heavy chemical department.

A native of Cleveland, Mr. Pynchon attended Ohio University and Western Reserve University. Before joining

Richard N. Pynchon

Cowles, he served in the Furnace Sales Division of the Perfection Stove Co. of Cleveland. During the Korean conflict, Mr. Pynchon was an instructor in the Eighth Army Engineer School in Japan.

Mr. Pynchon will be in charge of all of the company's advertising, sales promotion and public relations activities in all departments.

New Wisconsin Corporation

J. & W. Metal Polishing Co., Inc. has been formed in Sheboygan, Wis., with an authorized capital stock of 100 shares of common of no par value. The incorporation papers were signed by *Kenneth A. Jurk* and *Raymond E. Carson*, the former being given as the registered agent for the corporation at 1105 South 7th St., Sheboygan, Wis.

H-VW-M Appoints New Midwestern Field Chemist

Marking another step in a new policy of expanding its field service, *Hanson-Van Winkle-Munning Co.*, manufacturer of plating and polishing equipment & supplies, has assigned Electrochemist *William T. Walling* to the Chicago area.

Walling will be associated with *E. C. Bosl* who is presently covering this territory and several midwestern states. Besides supplementing the work of Bosl, he will be available for service throughout the Midwest. Walling moves to Chicago from Matawan where he has also been doing field electrochemical service work.

In addition to his electrochemical background, Walling has worked as a plater, and has experience in buffing & polishing. Originally trained at the company laboratory in Matawan, he

William T. Walling

was graduated from Seton Hall University with a degree in chemistry, and joined H-VW-M upon his graduation.

Detrex Promotes Richey

The *Detrex Corporation* of Detroit, manufacturer of industrial metal-cleaning machinery and chemicals has announced the appointment of *Phil H. Richey*, assistant treasurer, to the position of assistant works manager.

A. O. Thalacker, Detrex president, said that Mr. Richey will report directly to *R. A. Emmett, Jr.*, works manager of the company's Equipment Division in Detroit. Mr. Richey also will continue as assistant treasurer.

After graduating from the University of Michigan, Mr. Richey was associated with the Detroit Bank before joining Detrex in 1948. Advancing through various positions in the controller's office, he was appointed personnel director in 1950. Subsequently, he was assigned to special duties in the office of *E. W. Allison*, treasurer.

Seymour New President of Atlas Mineral Products Co.

George L. Wirtz, who was recently promoted to chairman of the board, has announced the appointment of *Dr. Raymond B. Seymour* as president of the *Atlas Mineral Products Co.* Seymour, the originator of furan cements and many of the other products of the Atlas line, joined the firm as chief chemist in 1939. Since 1949, he has been executive vice president and a member of the board of directors.

Seymour is the third president of this 64 year old firm. George L. Wirtz, who has resigned as president, succeeded his father, the late *Maximilian F. Wirtz*, founder and first president. *Joseph A. Snook* will continue to serve as vice president in charge of sales and engineering.

A native of Boston, Seymour received his B.S. and M.S. degrees from the University of New Hampshire and his Ph.D. degree from the University of Iowa. After serving as a graduate assistant at both schools, he joined Goodyear Tire & Rubber Co. as a plastics research chemist.

He has also been a research group leader at Monsanto Chemical Co., a director of the Industrial Research Institute of the University of Chattanooga and director of special products research for Johnson & Johnson.

He is the author of approximately fifty patents and more than one hun-

Dr. Raymond B. Seymour

dred technical publications, primarily on plastics as materials of construction. He was co-author of the "National Paint Dictionary," 3rd Edition 1948, and chairman of the committee chosen by *The Electrochemical Society* to write a supplement to the "Corrosion Handbook" on plastics. He is author of "Plastic Materials of Construction" to be published this year by Reinhold Publishing Corp.

He is a member of over thirty technical societies and has been an officer of the American Chemical Society and the American Association of Textile Chemists and Colorists. He is chairman of the Thermoplastic Structures Division of the Society of the Plastics Industry and the Industrial Research Education Committee of the National Association of Manufacturers.

He is married and the father of four children. The Seymours live in Emmaus, Pa.

Diamond Alkali Appointments

Two key organizational appointments at *Diamond Alkali Company* have been announced by President *Raymond F. Evans.*

C. A. Butler, Jr., director of engineering for this producer of basic chemicals since 1946, has been promoted to the newly-created post of director of commercial development. *Loren Scoville*, since 1951 vice-president in charge of engineering, purchasing and operations for Jefferson Chemical Co., New York, N. Y., has been named to take over Mr. Butler's work as director of engineering. Both appointments become effective April 1.

Actively associated with the firm's engineering and planning activities since 1941, Mr. Butler will assume his commercial development post in May following attendance at Harvard University's Advanced Management Training course. A native of South Dakota and an engineering graduate of the University of Iowa, Des Moines, he handled electrical and mechanical engineering responsibilities for major power plant installations throughout the midwest. He was associated with United Light and Power Co., Kansas City, Mo., for 15 years prior to joining Diamond.

A member of the American Society of Mechanical Engineers, the Cleveland Engineering Society, and Tau Beta Pi and Sigma Xi, honorary engineering and science fraternities, he has also written a large number of articles which have appeared in technical journals and periodicals.

After earning his B.S. degree from the University of Redlands, Redlands, Cal., and his masters in chemical engineering from California Institute of Technology, Mr. Scoville began his career with Southwestern Engineering in 1930. Two years later he joined the Texas Co.'s engineering department, his responsibilities eventually including process designing, economic studies, and projects engineering on many large refinery installations. Joining Jefferson Chemical when it was formed in 1944, as chief engineer, Scoville was immediately put in charge of plant design and construction. His subsequent responsibilities were extended to include plant operations.

A director of the American Institute of Chemical Engineers, Mr. Scoville is past chairman of the New York section of the organization and chairman of the program committee. He is also a licensed professional engineer in New York and Texas.

Married and the father of two children, Mr. Scoville presently resides in Tuckahoe, N. Y., and will move to the Cleveland area shortly.

Stevens Adds Smith to Staff

Harold W. Faint, Chicago district manager, *Frederic B. Stevens, Inc.* has announced the selection of *Charles W. Smith* as that company's newest representative in the Chicago area.

Charles W. Smith

Smith will specialize primarily in the Stevens line of metal finishing compositions. His experience, however, will permit him to service customers on plating equipment and supply problems as well.

Prior to joining the company, Smith had accumulated 26 years experience in the metal finishing fields. He has spent 3½ years as a superintendent at

Craftsman's Plating and Tinning Co., Chicago; four years as superintendent of plating, polishing and buffing at Driscoll Co., Chicago; and over three years in the same capacity at the Webster-Chicago Corp.

He specialized in chemistry while at school and has been a member of the Chicago Branch A.E.S. for the greater part of 20 years.

Minneapolis Man Named Sales Engineer for Udylite

Gottfred L. Hendrickson

Gottfred L. Hendrickson has been appointed resident sales engineer to serve the Minnesota, North Dakota and South Dakota area, it is announced by *L. J. George*, Chicago district manager of *The Udylite Corporation.*

Hendrickson brings to the company 20 years of experience in metal finishing. His previous experience included supervision of metal finishing at McGraw Electric Co. in Elgin, Ill., and at General Mills Home Appliance Dept. in Minneapolis.

He will service the area from his office at 1834 Lincoln Street, N.E., Minneapolis, Minn.

Pennsalt Creates New Operating Divisions

To provide more logical product grouping, better customer service and a suitable pattern of organization for expected future growth, the *Pennsylvania Salt Mfg. Co.* will establish two new operating divisions, President *George B. Beitzel* announced recently.

These new components — the Industrial Chemicals and Chemical Specialties Divisions — will function as complete operating units responsible for both the manufacture and sale of their respective products. Other units already operating on this basis are the Pennsylvania Salt Mfg. Co. of Washington, Sharples Chemicals, Inc., and Pennsalt International Corp.

Three major personnel appointments effective April 1st also were announced: *William P. Drake*, vice-president in charge of sales was named president of the Industrial Chemicals Division; *Albert H. Clem*, general sales manager, becomes president of the Chemical Specialties Division; and *William F. Mitchell*, formerly head of Pennsalt's manufacturing activities, becomes vice-president in charge of engineering, purchasing, and traffic for the consolidated company.

"Chandeysson Room" Established By St. Louis Hospital

Complete furnishings for a private room were recently donated to Alexian Brothers' Hospital, in memory of the late *Pierre I. Chandeysson*, founder of *Chandeysson Electric Co.*

This gift is one of many received by the Hospital from the Chandeysson family. Their interest is underlined by the fact that Dr. Chandeysson in his lifetime was always devoted to the medical work of the Alexian Brothers.

While Chandeysson established an enviable reputation as a business leader, he never lost his love for medicine — the profession for which he had been trained. Although he was a practicing doctor only one year, he always maintained his memberships in the St. Louis and American Medical Societies.

Permutit Opens New Metalworking Plant

The latest addition in a series of expansion moves — a projected $1 million building program — was formally dedicated in Lancaster, Pa. by *The Permutit Company*, before a gathering of city and county officials and local leaders of industry and commerce.

This new addition, a modern metalworking plant costing approximately $750,000, is the preliminary step to the eventual creation in Lancaster of a complete industrial center for the manufacture of several of the company's varied products for industry and home. "We have plenty of room to expand our present 83,000 square feet of working area," said *H. W. Foulds*, president, who officiated at the special ceremonies.

The plant itself will utilize the novel "U" assembly line technique for the flow of materials in process from their receipt at the receiving platform, carrying through manufacturing, storage, assembly, testing and shipping. The lighting intensity can be increased or decreased at the will of the operator simply by adding or taking away some of the lighting fixtures. The lights will not be connected permanently into the lighting circuits. These are but a few of the many features initiated by *George N. Proctor*, vice president of the company.

Provisions have also been made so that expansion of the building can be easily provided. With the installation of a 440 volt power system, the plant is adequately powered for future expansion. Power will be purchased from the Pennsylvania Power & Light Co.

Plant Manager and Assistant Designated by Permutit

The Permutit Company, New York, N. Y., with a newly completed 83,000 square feet factory on the outskirts of Lancaster, Pa., has announced the appointments of *J. Harrahill* as plant manager, and *F. K. Richardi* as assistant plant manager of the Lancaster Division.

According to *George N. Proctor*, vice-president, Mr. Harrahill, with the firm since 1947, was assistant plant manager of their Brooklyn, N. Y. plant from January, 1947 to December, 1951 when he was moved to Philadelphia as plant manager of the Simplex Valve & Meter Co., a wholly owned subsidiary.

Mr. Richardi joined the company in January, 1952 as assistant plant manager, to fill the position vacated by Mr. Harrahill. However, during the past two years, he has been acting plant manager of the Brooklyn plant. Both bring a great deal of experience into their new positions.

Jove and Bennett Retire from Norton

Norton Company of Worcester, Mass., announces the retirement of *William N. Jove*, field engineer in the Chicago area, after a career of over 51 years. *William D. Bennett*, abrasive engineer in Cleveland, retired after 46 years of service.

Mr. Jove started with the company as an errand boy at the Chicago store at the age of 13. Soon after, he began selling wheels over the counter at the store which was the predecessor of the

William N. Jove

present district office in Chicago. Later he became a member of the outside sales force as an abrasive engineer and field engineer, always in the Chicago area. At the 1952 Service Award Dinner, he was admitted to membership in the 50-Year Club as its fifteenth member.

Mr. Bennett began his career as an office boy, later working in the Order, Sales Quotation, and Sales Engineering departments before being sent to Cleveland in 1930 as office manager. Since 1931 he has been an abrasive engineer in the Cleveland area.

Harlan W. Cobb has been named to succeed Mr. Bennett. Another longtimer with 37 years in the firm's employ, Mr. Cobb has been at Cleveland

William D. Bennett

since 1929 holding positions as stock supervisor, junior abrasive engineer and office manager.

In another change among Norton sales personnel, *Fred J. Benn* was appointed an abrasive engineer and will be responsible for a new territory created by dividing the territory formerly covered entirely by *Sherwood F. Prescott*. Mr. Benn will center his activities in Louisville, Ky., and cover a large portion of that state. Mr. Prescott will continue his residence in the Cincinnati area and cover his portion of the territory which includes southern Ohio, and eastern Indiana.

William Reibitz, formerly field engineer in Detroit has been appointed abrasive engineer in the Detroit area, exchanging jobs with *Allan Jaques*.

Engineering Design Firm Adds Dust and Fume Control Division

Mars Engineering, Inc., 375 South St., Newark 5, N. J., has added a new division which will design industrial dust collection and fume elimination systems, according to *Albert C. Tess*, president.

The company until now has specialized exclusively in the design and manufacture of machinery. This service relieves engineering departments of peak loads and supplies special design know-how which individual firms do not have.

Bristol Co. Appoints Fleming

According to a recent announcement by *W. H. Faeth*, president of *The Bristol Company*, Waterbury, Conn., *John G. Fleming* has been appointed to the newly created position of product planning manager. According to the announcement this arrangement is in-

John G. Fleming

tended to provide a more concentrated and directed approach to the company's short term and long range planning of new and improved instrumentation.

Cratex Names Edward R. Bate Sales Manager

In line with new promotion and advertising plans, *Cratex Mfg. Co.* of San Francisco has announced the appointment of *Edward R. Bate* to the position of sales manager. Mr. Bate is well known on the West Coast for his industrial marketing activities. He will soon make field trips throughout the United States for the purpose of assisting company dealers and distributors in the sales and application of rubberized abrasive burring, smoothing and polishing products.

Northwest Chemical Co. Appoints Wilson

Marion F. Wilson has joined the sales staff of the *Northwest Chemical Co.* to service accounts in Kentucky, Tennessee, and parts of Indiana.

Mr. Wilson, a long time resident of Kentucky, served with the Air Corps in World War II and is a graduate of the University of Louisville, and a member of the American Society of Tool Engineers.

For the last several years, he has worked with the metal finishing industry. This experience, augmented by special training given by the company, enables him to render technical service of a high order.

Chase Chemical Corp. Appoints Kost

Chase Chemical Corp. announces the appointment of *Edward L. Kost* as general manager of the Industrial Lining Division. Mr. Kost has been superintendent of the lining plant at Edgeworth, Sewickley, Pa., and will be located now at the company's office, 3527 Smallman St., Pittsburgh.

Magnus Appoints E. H. Peterson

Magnus Chemical Co., Garwood, N. J. manufacturers of industrial cleaning materials and cleaning equipment has announced the appointment of *E. H. Peterson*, of Scotch Plains, N. J., sales manager.

With the company since 1947, Mr. Peterson has served in engineering and sales capacities, and was appointed assistant to the president in 1952. He formerly associated with Shaw Insula-

E. H. Peterson

tor Co., Irvington, N. J., and with Stewart, Dougall and Associates, management consultants, in New York. He is a World War II veteran of the Naval Service.

A graduate of Worcester Polytechnic Institute, he holds a Master's Degree from Stevens Institute of Technology, and is a doctoral candidate at New York University. He is a member of the Tau Beta Pi national honorary engineering fraternity, the American Management Association, the American Marketing Association, and is a Licensed Professional Engineer, State of N. J.

Whyco Chromium in New Plant

Whyco Chromium Co., Inc., announces that since April 15, 1954 all plating and office operations are being carried on at their new plant in Thomaston, Conn.

The new shop, equipped with all the latest types of commercial and Whyco designed automatic equipment, will have four times the old capacity. Service to customers will, therefore, be more prompt and efficient.

American Electro Products Adds to Plant

American Electro Products, Inc., 1358 Thomaston Ave., Waterbury, Conn., originator of the *Cantavone* electroplating processes and techniques, has completed construction of a wing which more than doubles the production capacity of its former plant. The new building features the latest equipment available in the electroplating industry.

The company is presently plating precision components for numerous industrial and Government applications, with chief emphasis on the use of gold and silver.

News from California

By Fred A. Herr

Members of the Southern California plating industry were guests of the *L. H. Butcher Co.* at an open house celebration on April 7 marking the official opening of a new $250,000 factory addition for the manufacture of buffing and polishing compounds, plating equipment, and laboratory facilities for control, development and research.

The addition, which is at the rear of the company's main plant at 3628 East Olympic Blvd., Los Angeles, contains a compound mix room, including facilities for liquid mixes, brighteners and cleaners; a control and research laboratory; a pilot plating department; and office, engineering and stock room areas. Spacious manufacturing departments for producing buffing and polishing compounds are also included.

Some 600 members of the Southern California plating fraternity participated in the dedication ceremonies which were held between 5 and 8 p.m. They were taken on guided tours through the manufacturing areas and a metal finishing equipment exhibit. Executives and staff members of the company served as guides. A buffet meal was served. LHB executives and personnel present to greet the visitors were *L. K. Lindahl*, president; *W. D. Schwartz*, former president of LHB and now executive vice-president under the Udylite banner; *Jack Raskin, supervisor*, LHB West Coast plating division; *Earl Arnold*, assistant supervisor; *Dean Williams* and *Frank Virgil*, Los Angeles sales staff; *Almont Peterson*, Salt Lake City; *Richard Coen*, San Francisco, *H. C. Humphries*, Portland, Ore.; and *Lloyd Shortes*, Seattle, Wash.

The trip which brought *Myron B. Diggin* of Hanson-Van Winkle-Munning Co., to California in March to address Los Angeles A.E.S. Branch (March 20) and San Francisco Branch (March 25) promised to be quite an extended one before he could look forward to a respite in Matawan, N. J. around mid-May. Before coming to California, he addressed AES groups in Pittsburgh, Pa., and Baltimore-Washington. Flying home from San Francisco, he made talks in Chicago, Ill., Lansing, and Detroit, Mich. He reached Matawan in time to repack his bag, grab his passport and leave with Mrs. Diggin for London, where he was to address the International Electroplaters' convention in April.

Kenneth W. Baum has joined the research and development staff of Harshaw Chemical Co. at Los Angeles. He had previously served for eight years as a chemist in Harshaw's Cleveland headquarters.

Robert J. Mekervis, supervisor of metallurgical development for the Tin Research Institute, Columbus, O., was a recent visitor in Los Angeles. His visit was designed to learn, through conferences with prominent tin users, the extent to which tin is used in the plating and other industries on the West Coast. He talked with representatives of the automotive, aircraft, steel, milk and other industries, as well as with plating shop operators and supply house representatives.

The Columbus, O., office serves as the American branch of the Tin Research Institute, whose headquarters are in London. It functions as a consultant to tin users and is sponsored by the tin producing nations, principally Great Britain, British Malaya, Belgium, Holland, Indonesia, Nigeria, France and Indo-China. During his Southern California stay, Mr. Mekervis took occasion to visit the Kaiser Steel Co.'s plant at Fontana, Cal., where a large electrolytic tin line is in operation for processing sheet and strip steel.

Richard G. Herbst, 61, operator of the Herbst Plating Works, Santa Barbara, Calif., for the past 26 years, died of chronic leukmenia-bronchial pneumonia on March 19 at the Veteran's Administration Hospital at Sawtelle, Cal.

He leaves his wife, Rene, a son, Richard, Jr., 14, a daughter, Laurene, 8, and a sister, Mrs. Margaret Ball, all of Santa Barbara.

Mr. Herbst joined Los Angeles Branch of the *American Electroplaters' Society* shortly after its founding in the early 1930's and was an active member until overtaken with illness six years ago. During his illness, Mrs. Herbst managed the plating business, with the aid of *Joe Gonzalez*, formerly of Detroit, who superintended the actual polishing and plating of silverware, the work in which the shop specialized.

Slowly regaining strength after the severe heart attack which he suffered in January, *Marcus Rynkofs*, owner of Liberty Plating Co., Los Angeles, hopes to take off with Mrs. Rynkofs around June 1 for a leisurely motor tour through the mid-West, South and New England. They expect to spend the summer visiting Chicago, Detroit, Cleveland, Pittsburgh (their old home), Nashville, Baltimore, Philadelphia, New York and Vermont, returning to California via Milwaukee, North Dakota, Montana and Salt Lake City.

Carroll McLaren, former owner of the Santa Ana Plating Works, Santa Ana, Cal., holds a record unparalleled in the annals of Los Angeles Branch of the AES. When Carroll registered at the March 20 annual educational

session, it marked the 23rd consecutive year he had attended that event. He missed the Branch's first annual session in 1930 (he wasn't a member then), but has been present and accounted for every year since.

Bruce U. Smith, owner of Metal Treaters, formerly at 9087 West Washington Blvd., Culver City, Cal., expected to have his facilities moved into a new plant at 414 West Florence Avenue, Inglewood, by May 1.

The new plant measures 40 x 100 feet and represents a cost of $30,000 in building and equipment. It has been equipped for black oxide processing of trailer parts, jacks and trailer overload springs and the building of heat treating furnaces and adjunct equipment.

H-VW-M Expands Western Sales and Service Force

To meet the increased needs of the western metal-finishing industry, *Hanson-Van Winkle-Munning Co.*, Matawan, N. J., has expanded its sales and service force west of the Mississippi.

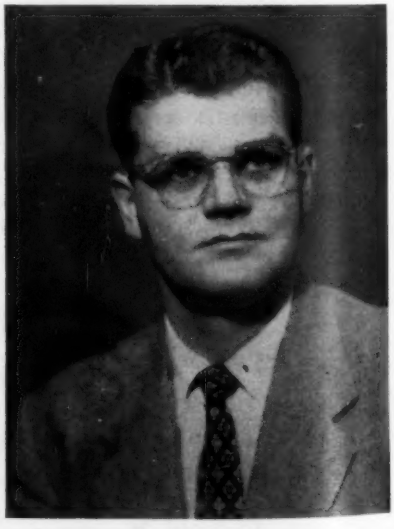
Steps taken in recent weeks by this manufacturer of electroplating and polishing equipment and supplies, include the intensification of plating supply activity on the Coast, opening of a new office in St. Louis, and the extension of sales and service facilities to cover all major western industrial areas.

C. A. Pickering

H-VW-M recently purchased the Electroplating Equipment & Supply Division of A. J. Lynch Co., Los Angeles, which formerly represented it in California. Its newly acquired facilities and personnel are being used to extend sales and service coverage from California to Washington, Oregon, Idaho, Nevada, Utah, Arizona, New Mexico, Wyoming and Montana.

Headquarters have been set up at the new St. Louis office to service Kansas, Oklahoma, Arkansas, Texas, Louisiana, Missouri and the St. Louis trading area in Illinois. *Joseph J. Cizas* was recently appointed sales representative for the territory.

Formerly this territory besides other western states was covered by *C. A. Pickering* of H-VW-M. Under the new expansion and consolidation plan,



William A. Nairne

G. Stuart Krentel

Pickering will concentrate his sales activities in Colorado, Nebraska, Iowa and northwestern Illinois. *L. J. Moyes*, presently covering Wisconsin and Minnesota, will acquire the territories of North and South Dakota. Supervising the areas covered by the three is *R. R. Granquist*, who maintains his headquarters in Chicago.

As a result of the purchase of Lynch's plating division, three Lynch plating salesmen joined H-VW-M. They are *William A. Nairne*, *G. Stuart Krentel* and *A. H. Nicholson*. All three have had extensive experience in the plating and polishing fields.

Nairne was with Lynch for six years. A graduate of the University of Arizona and a member of the *American Electroplaters' Society*, he will continue to cover the Los Angeles territory.

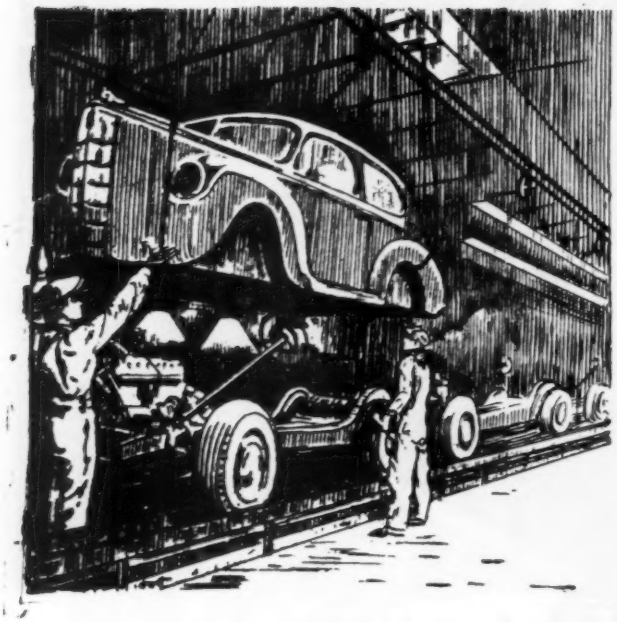
Krentel, recently elected president of Los Angeles branch of the Society, has been connected with the electroplating business since receiving his M.S. degree from Michigan State College in 1933. He will continue to cover Los Angeles with Nairne.

A. H. Nicholson

Krentel's background includes research and development work at Chrysler Engineering Corp. and Rufert Chemical Division of Seymour Mfg. Co., production and control work with Bay Manufacturing Division of Electric Auto-Lite Corp. and Spence Electro Plating Co. of Los Angeles, and sales and service work with MacDermid, Inc.

Nicholson, who will continue to serve the San Francisco area, has been associated with the metal finishing industry for the past eight years. A graduate of Wooster College, Wooster, Ohio, he worked as a plating chemist for Daystrom Corp., Olean, N. Y., for three years. He later supervised metal finishing operations at Daystrom's west coast plant in Fullerton, Calif. Nicholson, a member of the A.E.S., was also formerly associated with Sundmark Supply Co.

Retaining supervision of west coast operations is *Harold R. Smallman*, assistant vice president of H-VW-M. Under the new arrangement the firm will retain its principal western distributors. They include Carl F. Miller Co., Seattle and Spokane; Zehrung Chemical Co., Portland; Southwestern Platers' Supply Co., Dallas; Brance-Krachy Co., Houston; E. R. Frost Co., Minneapolis and G. S. Robbins Co., St. Louis.



MOTOR CITY PLATING NEWS

Detroit Branch

The Detroit Branch held its second Annual Ladies Night at the Hotel Statler on Friday, March 5th, 1954.

President *L. C. Borchert* called the meeting to order at 8:30 P.M. with about 200 members, wives, and guests present. Honored guests were *Alan A. Pearson*, Morris Motors, Ltd., Oxford, England and *J. A. Bechtold*, M. L. Aikan, Ltd., Middlesex, England.

The total membership of the branch is now over 600 members, a record for the Branch and Society. Eighteen new members augmented this. *Joe Gurski* thanked the members for their assistance in the membership drive.

Walter Pinner, Houdaille-Hershey

Corp., was then introduced as the principal speaker for the evening. His subject "Vacation in Mexico" showed approximately 275 colored slides taken by himself while he and his wife vacationed in Mexico last year. Beautiful scenery and points of interest in Mexico City, Acapulco, Monterrey and other cities were seen by a very attentive audience. Mr. Pinner narrated while showing slides telling of interesting events occuring during the trip. The program was enjoyed very much by the whole group.

Socialibility followed the meeting with the serving of refreshments.

E. J. Kubis
Asst. Sect. Treas.

Miller Promotes Badaluco

James A. Badaluco

James A. Badaluco has been promoted to executive vice president of the *J. C. Miller Co.*, producers of buffing compounds, it was announced by *G. H. Walgren*, president of the firm.

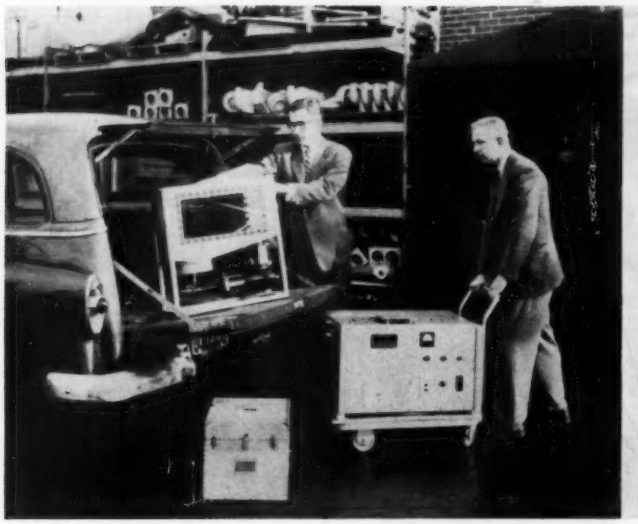
Mr. Badaluco has specialized in the development of buffing compounds in the last few years, although he is experienced in all phases of the business.

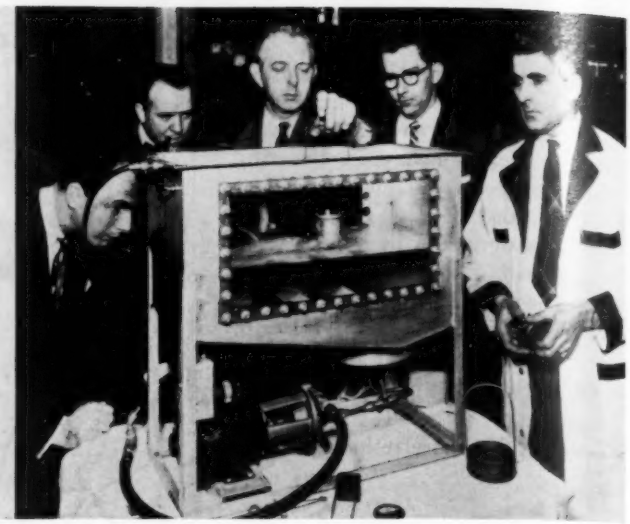
A native of Grand Rapids and graduate of South High School, he received a chemical engineering degree at the University of Michigan in 1937.

He is a past president of the West Michigan chapter of the *American Electroplaters' Society*.

Detrex Team Demonstrates Ultrasonic Cleaning

The *Detrex Corporation* of Detroit has "taken to the road" to tell American industry the story of the remarkable advances made in the of ultra-





Left: Donald C. Johnson and Kermit D. Collom, members of the ultrasonic demonstration of the Detrex Corporation, unload generator and small, ultrasonic degreaser. Right: Collom, center, shows speed and thoroughness with which sound energy degreases metal part, as key plant executives watch through glass sides.

sonic energy for the precision cleaning of metal.

It was just a year ago that this manufacturer of industrial metal-cleaning equipment and chemicals announced it had taken high-frequency sound energy out of the laboratory stage and had developed its fully-conveyorized Soniclean Process — its ultrasonic metal cleaning system that was practical for the needs of modern industry.

To answer a flood of inquiries, the company first tackled the huge job of sorting through and indexing them. Then followed the publication of a technical brochure. The next step was the formation of a special team of ultrasonic demonstrators and the preparation of an itinerary that will keep them on the road for an indefinite period.

Headed by *Kermit D. Collom*, in charge of ultrasonics sales, installation and service, demonstrators will show ultrasonics in action with the aid of a carefully-assembled, complete kit including a small degreaser, a ¾-kilo-

watt generator, solvent, plastic-coated baskets, magnetic field detector, microscope, variable-position transducer holders, tool kit, and other miscellaneous items.

The demonstrations will be made in hotels convenient to many firms in a given area, before meetings of technical societies, and directly in the plants of individual companies. Hotel demonstrations held so far have drawn representatives from firms hundreds of miles distant.

A full-sized degreaser, incorporating an ultrasonic cleaning cycle, has been installed in the Detrex laboratories in Detroit for demonstration purposes. Glass windows in both this machine, and the smaller, portable unit, permit spectators to watch sound energy at work.

Arthur A. Conrad, Jr., Joins International Nickel's Detroit Technical Section

Arthur A. Conrad, Jr., metallurgist, has joined the Detroit Technical Section of International Nickel's Development and Research Division, according to an announcement by *T. H. Wickenden*, vice-president and manager of the division.

A graduate in metallurgical engineering of the Carnegie Institute of Technology, Pittsburgh, Pa., Mr. Conrad prior to his present appointment was chief metallurgist with Precision Metalsmiths, Inc., Cleveland, Ohio. Previously he had been engaged in metallurgical work with Carnegie-Illinois Steel Corp., Pittsburgh and Duquesne, Pa., National Tube Co., Lorain, Ohio, and at U. S. Steel Corp.'s research laboratory, Kearny, N. J. He saw military service with the U. S. Naval Reserve in 1942-46.

Mr. Conrad is a member of the *American Society for Metals*, the *American Society for Testing Materials* and the *American Foundry Society*.

Associations and Societies

AMERICAN ELECTROPLATERS' SOCIETY

CONVENTION NEWS

Plans for the Forty-First Annual Convention of the A.E.S., to be held in New York City at the Statler Hotel, July 12-15th, are running along smoothly, and from all indications this will be the most outstanding convention to date.

Martin Maher and *Albert Fusco*, co-chairmen of the Pre-Registration Committee, have announced that a member may register for himself and his wife by enclosing forty dollars for their combined registration. Upon arrival it will only be necessary for him to pick up one envelope, thereby eliminating the need for his wife to stand in line to register. This same procedure may be followed by companies who may wish to register several of their men (and wives, if desired). The registration fee of $20 per person ($12.50 children under 12) should be attached to company letterhead. One person may pick up all registrations for the company. As mentioned in a previous release, the committee will refund money in full for any registrations not used.

Angelo Amatore and *George Herrmann*, Hotel and Banquet Co-Chairmen, report that rooms at the Statler are being reserved at a rapid pace, and suggest that in order to be sure of a room at the Convention Headquarters, people planning to attend should make reservations at an early date.

Moe Ranno, chairman of Visitors' Entertainment Committee, announces that tickets for radio and television

shows will be available anytime during the convention. Broadway shows, night clubs, fishing trips, tours, visits to many famous sites, etc., will be available to conventioneers.

Jim Clifford, Entertainment Chairman, reports that he has arranged a top-notch program to be presented at the annual banquet.

Phil Bruno, Outing Chairman, has lined up a fine program for the boat ride and outing to be held Wednesday, July 14th.

Milton Nadel, Educational Chairman, has added a technical session for Wednesday morning. This will give educational sessions for each day of the convention.

We are pleased to announce that in addition to the very fine ladies program which had previously been announced, the *Lea Manufacturing Co.*, *Wagner Brothers, Inc.*, and the *F. L. and J. C. Codman Co.* have agreed to jointly sponsor a Ladies Tea which will be held Monday afternoon, July 12th. The committee wishes to thank the above and all other firms who are aiding in making this a real outstanding program.

Los Angeles Branch

New attendance records were established for the technical meetings as well as the dinner dance at the 24th Annual Educational Session of Los Angeles Branch, *American Electroplaters' Society*, held on March 20 at the Los Angeles Ambassador Hotel.

General chairman *William Nairne* and co-chairman *George Hetz* reported attendances of 160 at the morning and afternoon technical sessions, 175 at the mid-day luncheon, and 602 at the dinner dance in the evening.

The first technical session was called to order at 10 a.m. by Librarian *George Magurean*. The morning talks dealt with two important aspects of plating shop operation — instrumentation and surface active agents.

The first speaker was *Robert A. Bailey*, Beckman Instruments, Inc., South Pasadena, Cal., who spoke on "Instrumentation In The Plating Industry."

Mr. Bailey declared that the use of instruments for various types of control and measurement in the plating industry has grown far beyond the simple voltmeters of old into the field of scientifically constructed devices for accurate instrumentation. With high-speed operations now in vogue, the present trend, he stated, is to obtain better and faster production through improved and more accurate control of temperature.

Mr. Bailey devoted some time to discussing the application and operation of instruments designed to control variables such as temperature, acidity, alkalinity, waste water, etc., and to instruments used for solution analysis.

He discussed pH control as an introductory to a comprehensive outline of that phase of plating. He touched on the need for proper pH control in other finishing operations, such as cyanide-cadmium, cyanide-copper, alkali cleaning and lead-tin plating. He devoted the last half of his talk to explanatory comment for a series of slides, some of which illustrated the following items: Construction of a glass electrode for measuring pH; immersion type electrode assembly; flow assembly of glass electrode for pH measurement; automatic temperature control system for plating tanks; and recording thermometer installation with pneumatic control.

Dr. Henry Brown of the Udylite

Corp., Detroit, Mich., next presented a talk on "The Role of Various Surface Active Agents in Electroplating Baths." In the course of his extemporaneous remarks he frequently referred to a blackboard on which various formulas showed the lowering of surface tension by detergents. The three major uses of active agents, he said, are as brighteners, as anti-pitting materials, and as anti-spray materials to prevent harmful spray or misting from zinc, chromium and other solutions. He discussed the properties of and uses for synthetic detergents, Turkey red oil, detergents made from coal tar, kerosene and coconut oil. With a miniature laboratory set up on the platform, Dr. Brown gave demonstrations of the different reactions of various surface agents.

The afternoon session was called to order at 2 o'clock. *Robert W. Couch*, United Chromium, Inc., Detroit, Mich., was the opening speaker, and his subject: "Recent Developments In Chromium Plating." He gave an outline of the progress that has been made with chromium plating from cold solutions as low as 65°F. This process is used primarily, Mr. Couch said, for decorative plating directly on aluminum. He described deposits from a cold chrome solution as dull, matte gray in color which results in fairly soft deposits, but which are easily buffable. He also offered the solution make-up and refrigeration requirements.

Mr. Couch also devoted some of his time to a discussion of crack-free chromium. The greater portion of this phase of his remarks was in the form of explanatory comment for a series of slides which showed sample parts and cross-section diagrams of crack-free deposits. One of the slides gave the hardness measurements as follows:

A production advantage of crack-free chromium with its greater production potential is that it may reduce equipment requirement because its use might do away with the need for copper and nickel undercoats, according to Mr. Couch. Its better ductability, he added, may be an advantage if forming after plating is called for. Mr. Couch's talk was concluded with a discussion of the fatigue properties of chromium deposits.

The second speaker on the afternoon program was *Myron B. Diggin* of Hanson-Van Winkle-Munning Co., Matawan, N. J. In his talk on "Helpful Hints On Unusual Plating Problems" Mr. Diggin related a series of experiences in which the H-VW-M technical staff had been called upon to solve perplexing problems confronting platers running the gamut of finishing troubles from tricky buffing matters to finding ways of overcoming the magnetization of metal parts.

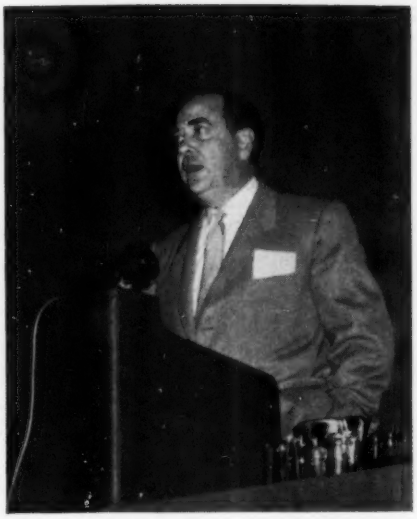
One hundred and seventy-five members and guests were assembled beneath the palm trees of the Coconut Grove when Chairman *Walter B. Behlendorf* called the noon-day luncheon to order at 12:15 o'clock.

Except for the introduction of distinguished out-of-town guests, the traditional taboo against anything resembling business or technical discussion was observed by Chairman Behlendorf. He called for volunteers for the Story Telling Contest. This feature of the noon-day luncheon was introduced at the Los Angeles Breakfast Club some six years ago, the purpose being to ascertain who can tell the tallest tale in the most engaging man-

ner. After the various contestants had had their chance at the microphone, the audience was requested to select two winners by volume of applause, basing their decisions not only on the story's plot, but on the manner of presentation, the fervor of its telling, dialectal proficiency, gesticulations and unexpectedness of the punch line.

Larry O'Neil of L'Hommedieu was chosen first prize winner. He told a heart-rending story about a veteran of the Pacific War who returned to his Georgia home to find that he was on the verge of being finagled out of his peach farm by some very unscrupulous characters. Larry pulled out all the stops of bathos, pathos and patriotism in relating the horrible dilemna that confronted the war hero at the height of the finagling and how he finally decided that he would not be engineered out of his peaches.

Carroll McLaren, job shop operator, won second prize with a tale of the experiences of a Japanese draftee undergoing his pre-induction examination. Carroll presented the story with such dramatic impact, including inimitable gestures and the wearing of a pair of prop eye-glasses, that he gave



Myron B. Diggin, Hanson-Van Winkle-Munning

Robert Couch, United Chromium, Inc.

O'Neil a close run for first prize. Others who submitted stories included *Alex Heller*, *Herold Kroesche*, *George Hetz*, *Rhys Ricky* and *Harold Boyd*. McLaren, incidentally, has established a high-class reputation as a raconteur, having won first prize last year with a masterpiece about a salesman, seventeen martinis and a bull-fiddle.

The dinner dance was held in the Embassy Room of the Ambassador Hotel, beginning at 7:30 p.m., with 602 in attendance — a record crowd for these affairs, according to Nairne.

The committees which made the arrangements for the educational session and dinner dance were staffed by the following branch members: General chairman, *William A. Nairne*. *George Hetz*, co-chairman. Educational, *George Magurean*; reservations, *Lawrence O'Neil*, *Harvey Hunt* and

(Photos by G. Stuart Krentel, Los Angeles Branch.)

From left to right: Dr. Henry Brown, Udylite Corp., Detroit, Mich.; Robert Bailey, Beckman Instruments, Inc., So. Pasadena, Calif.; George Magurean, Los Angeles, Calif., chairman of the Technical Session, Los Angeles A.E.S. March 20, 1954.

Warren Davis; luncheon and registration, *Walter P. Behlendorf* and *Fred J. Raymond;* door prizes, *Frank Virgil, David F. Seymour, Warren Blazer* and *William Lidtke;* publicity, *George Hetz;* photographs by *G. Stuart Krentel;* entertainment, *Harold Wanamaker* and *Dexter Halldin;* favors, *Robert J. Schlosser.*

Hartford Branch

The regular branch meeting was held at the Bond Hotel on March 15th and 71 members and guests were present. Preceding the meeting a movie entitled "Fair Exchange" was shown through the courtesy of the New York Stock Exchange.

The guest speaker for the evening was *Robert H. Tiers,* chief chemist of the W. D. MacDermid Chemical Co. whose subject was "Metal Cleaning."

Mr. Tiers related many of his experiences while trouble shooting in the metal cleaning field. It was pointed out that present methods of checking cleaners are inadequate and there is no satisfactory explanation of how a cleaner works. No standard soils are available to check cleaners or to run comparative tests on. Mr. Tiers showed many slides on soiled panels compared in a so called swirl test cleaning unit which compares the amount of soil removed by various cleaners. Also another set of slides showed an apparatus which compares the life of the cleaner.

The technical chairman for the evening was *Emile Beloin.*

Stanley Platoz,
Secretary

Waterbury Branch
New England Regional Meeting

Participating Branches: New Haven, Hartford, Springfield and Waterbury.

To be held at Bond Hotel, Hartford,

Conn., Saturday, May 15, 1954.

Technical Session: 2:00-5:00 P.M.

Dinner at 7:00 P.M.

Music and Dancing after dinner.

Speakers Program:

1. *Dr. Abner Brenner*, Chief of Electrodeposition Section, Bureau of Standards, "Current Status of Electroless Nickel Plating."

2. *Dr. Wilfred Roth*, Treasurer and Director of Research, Ultra Viscoson Corp., "Ultrasonics as applied to Metal Finishing."

3. *Ezra Blount*, Editor of Products Finishing, "To be announced."

Chicago Branch

On Friday evening, March 12, Chicago Branch scored another success. The success was its joint meeting with the Chicago Section of *The Electrochemical Society*, held under the auspices of Chicago Branch.

A substantial number of members from both organizations gathered at the Western Society of Engineers to hear *Dr. M. L. Holt*, Professor of Chemistry at the University of Wisconsin speak on the electrodeposition of alloys of the less common metals.

Before the technical meeting, it was announced that, *H. A. Gilbertson*, one of the charter members of Chicago Branch was recently hospitalized. The entire Branch extends its wishes for a speedy recovery to Mr. Gilbertson.

Then the very important business of the election of officers took place. The following slate, submitted by the nominating committee, was voted unanimously into office.

President: *Edward Stanek.*

First V.P.: *Simon P. Gary, Jr.*

Second V.P.: *Ralph Petite.*

Sec.-Treas.: *Paul Glab.*

Librarian: *Dr. Russell Harr.*

Delegates: *Clyde Kelly, Paul Glab, Edward Stanek.*

Alternate Delegates: *Joseph M. Andrus, Raymond F. Ledford, H. A. Gilbertson.*

Board of Manager: *Joseph M. Andrus, Ovide Bedard, William H. Murphy.*

After the election of officers, Dr. Holt gave his talk on the deposition of alloys of the less common metals. He discussed the elements in groups IVb, Vb, VIb, and VIIb. He listed the baths used for the deposition of alloys of cobalt and molybdenum, iron and molybdenum, chromium and molybdenum, and nickel and molybdenum. In depositing these alloys he found that best results were obtained through the use of citrates and tartrates as complexing agents. Dr. Holt discussed the nickel-molybdenum bath in some detail. He listed some effects such as alloy composition and current efficiency and the effect of operating variables such as current density, concentration, pH, and temperature upon them. Finally, he pointed out that the deposit is highly stressed and thick deposits of the alloy crack and peel.

After the talk there were many questions asked from the floor, and a lively discussion period ensued which was enjoyed by all.

Jerome Kuderna
Publicity Chairman

New York Branch

Held March 12, 1954 at the Hotel Statler, New York, the meeting was called to order by *A. Amatore*, president, and a roll of officers was called.

The following men were elected to membership and duly installed:

R. Williams, L. Boccie, L. Bricker, S. Yank, J. Church, I. Simmons, A. Galfunt, C. Morla, Jr.

The following transfers were read and accepted by this branch:

S. Geffon (Newark) and *E. Quinlon* (Detroit).

The next order of business was nominations and election of officers for this Branch for the coming year.

George Herrmann made a motion that the present slate of officers for the branch be carried on for the coming year, with one exception, that being *Milton Nadel*, member of the Board of Managers, whose term expires. Mr. Herrmann's reason for the motion was that he thought it wise to carry the present board over due to the National Convention being held in New York City this year. Mr. Nadel seconded the motion. It was presented to the membership and duly carried. *George Schore*, secretary-treasurer, then cast one vote for the present slate of officers, thus electing them for the coming year.

Mr. Nadel nominated *F. MacStoker* as member on the board of managers —nominations were closed and Mr. Schore again cast one vote for Mr. MacStoker.

The meeting was turned over to the librarian Peter Veit who, in turn, presented a Question and Answer period.

Lester Levinson
Recording Secretary

Baltimore-Washington Branch

On Saturday, March 13, 1954, the Baltimore-Washington Branch held its annual Educational Session, banquet and dance in the Caswell Room of the Lord Baltimore Hotel, Baltimore, Md.

During the afternoon session three excellent technical talks were presented They were:

"Aluminum Anodizing" by *Herberth Head*, Member of the Production Managers Staff, Automotive Body Division, Chrysler Corp.

"Nickel Plating" by *Richard Saltonstall*, Technical Director, The Udylite Corp.

"Unusual Plating Problems and Their Solution" by *Myron Diggin*, Director of Research, Hanson-Van Winkle-Munning Co.

In the evening, following the banquet, the guest of honor, Supreme President *Dr. George P. Swift* was inducted into the Order of the Pot by Past-President *Ken Huston*.

Included along with Dr. Swift in the list of guests was his wife, A.E.S. Executive Secretary *P. Peter Kovatis*, who, with his camera, was probably the busiest person there, and the following members of the Research Committee, *Dr. William Blum*, *Dr. E. Parker*, *Myron Diggin*, and *E. R. Bowerman*.

Waterbury Branch

The regular monthly meeting of the Waterbury Branch was held on March 11, 1954 in the Colonial Room of the Hotel Elton. After a dinner preceding the meeting, President, *Frank Eddy*, opened the forum with the election of new members. He then reported briefly on the interim meeting held in Toronto, Canada, which he attended with *E. T. Candee*. Mr. Eddy stated that the main topic of discussion was how to get more and better technical papers for "Plating."

Dr. George Dubpernell, chairman of the nominating committee, presented the following slate of officers: President, *Perry Sloane*; V.P. *Joseph Petrocelli*; 2nd V.P. *Frederick Foster*; Secy.-Treas., *S. L. Henn*; Asst. Secy., *Arthur Tracy*; Librarian, *Theodore Voyda*; Asst. Librarian, *Ed Garland*;

Director of Publicity, *William Innes*. Board of Managers; *Francis Eddy, E. V. Collins, E. W. Couch*. Delegates: *W. V. Coleman, E. T. Candee, F. T. Eddy*. Alternate Delegates: *W. P. Innes, B. W. Sage, F. Tirendi*. There were no nominations from the floor.

George Tatoian, technical chairman, took over the meeting and introduced Dr. George Dubpernell, who gave his usual excellent book review, choosing a German technical book, which is a counterpart to our METAL FINISHING GUIDEBOOK.

After the showing of a movie entitled "Decision For Chemistry" Mr. Tatoian introduced the speaker of the evening, William P. Innes, technical director of MacDermid Inc., who spoke on "Factors Influencing High Speed Plating." Mr. Innes briefly described the basic factors governing the speed of plating, how they could be applied to present plating solutions, and what equipment is necessary to achieve high rates of deposition.

After a lively question and answer session the meeting adjourned at 10:00 P.M.

William P. Innes,
Publicity Director

Jackson-Lansing Branch

The regular meeting of the Jackson-Lansing Branch was held in Jackson March 9, 1954. A Southern fried chicken dinner preceded the meeting and tested the capacity of all present.

E. E. Murray of the Murray-Way Corp., Detroit, was the speaker of the evening and the topic was "Prefinishing of Steel prior to Electroplating," emphasizing methods of polishing flat stock prior to form operations. Excellent projected pictures of equipment of various types were shown and their purposes explained. Of great interest was a series of slides showing polished results of back stand operations with belts from 100 to 320 grit, using new-dry, used, and used-oiled set-up conditions. A second series of slides shown were of copper plated (periodic reverse) polished steel with a variation between five micro-inch and ninety micro-inch polish finish. These definitely showed the need for better base metal finishing, causes of corrosion, entrapped gases, solutions, etc.

The talk was an outstanding demonstration that the best plating, regardless of procedure, cannot overcome poor base metal finishing and, likewise, the better the base metal finishing the more uniform the deposition and increased resistance to corrosion.

The largest group in attendance for the year were present. Our thanks and appreciation to Mr. Murray.

R. W. Redmond,
Publicity

Indianapolis Branch

Thirty-three members and guests attended the March 3rd, 1954 meeting and at 8:00 P.M. three additional members came in for meeting and program. Following introductions, the secretary and treasurer's reports were read and accepted.

Herb Kennedy gave a report of the progress of the regional meeting at Cincinnati on April 3rd and also announced he has tickets. *Robert Van-Houten*, chairman of the local dinner dance of May 15th asked for committee reports. *Marshal Whitehead* reported on sustaining contributions, *Robert Bruck* on tickets, *Edward Bruck* on entertainment and *Edna Rohrabaugh* on favors. *Lowell Fisher* will have charge of out-of-town hotel reservations at the Athletic Club.

Mr. Bruck, a delegate, reported on

the March 13th Interim Meeting at Toronto, Canada. This report in on file with the secretary's records. *John Holland* suggested the idea that the branch present one paper per year to "Plating." *Abraham Max*, president, appointed Mr. Holland as chairman of a committee to investigate this situation and report at the next meeting. The chairman is to select two other members for the committee.

Cliff Cough suggested the branch put aside $200.000 for research work. After considerable discussion, the idea was tabled until next meeting. Another suggestion to have a ten minute question period at each meeting is to be considered. The committee in charge of information on *Richard Hennessey*, who is in line for honorary membership, reported and presented a prospectus to the executive board.

In the absence of *Roman Bender*, librarian, *Earl Messmore* introduced the speaker who was *Walter E. Pocock* of Allied Research Products. His subject was "Chromate Conversion Coatings." He told of the process, qualities and colors of chromate finishes on zinc and cadmium plating, on aluminum and other metals such as copper, alloys of copper which include brass and bronze and on magnesium. There is work being done now on steel and silver. After a question period which the group participated, the meeting adjourned at 10:10 P.M.

Edna Rohrabaugh,
Secretary

THE ELECTROCHEMICAL SOCIETY, INC.

The Industrial Electrolytic Division of the Society announces sessions at the Chicago Meeting of the Society in the LaSalle Hotel, May 2-6, 1954. The Division plans general papers including those in the chlor-alkali field with emphasis on mercury chlorine cells on the morning of May 3. The afternoon of May 3 will include a round-table discussion on chlorine compression. A symposium on "Molten Salt Bath Electrolysis" will be held Tuesday, May 4, including papers on aluminum, zirconium, and molybdenum in the morning, and on titanium in the afternoon. The program should be of wide interest to workers in the fields of Electrothermics, Electrodeposition, Rare Metals, as well as Industrial Electrolysis; and the Division accordingly invites attendance of those interested at its sessions.

LETTERS TO THE EDITOR

METAL FINISHING
381 Broadway
Westwood, N. J.

Gentlemen:

Please accept our congratulations on your excellent article on descaling in your February, 1954 issue.

We feel that this article will be of invaluable help to us and would appreciate receiving three copies.

Very truly yours,
J. W. Rex Company
T. W. Ferguson, Jr.
General Manager

Dear Mr. Hall:

I was astonished ot read Mr. J. Gordon Seiter's remarks in the March issue

of METAL FINISHING on my article, "Vacuum Metallizing and Plating — A Comparison," which appeared in the December issue of your magazine.

In the light of Mr. Seiter's comments, I reread my article and must confess that Mr. Seiter read into the article statements which were not meant, and reached conclusions which are not true. I stand behind the statements that I made in the article. I pointed out the merits of both types of finishes and when and where they are applicable. While I did not go as all out for vacuum metallizing as Mr. Seiter would have liked to see me go, I find no basis for his unmitigated attack on me.

Mr. Seiter sees things only from his biased point of view. I, having no axe to grind or product to sell, tried to give a generalized, and what I considered an unbiased study of the comparative finishes.

Mr. Seiter apparently became quite aroused when I stated . . . "a good plating and polishing job is much superior to vacuum metallizing . . ." He very glibly went on to cite the tremendous strides in the field of organic finishes and their application to vacuum metallizing, yet, he assumed that all plated work, if lacquered, is done by applying a thin water-dip lacquer. Mr. Seiter apparently does not realize that these same modern, superior organic finishes can be applied, and are applied, to plated and polished work too, with better and more lasting results.

Very truly yours,
Isidore Cross

NEW BOOKS

Specifications and Tests for Electrodeposited Metallic Coatings

Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 1953. Price $1.85. Paper cover. 85 pages.

This small volume brings together in convenient form the ASTM tests and specifications pertaining to the field of electrodeposited metals. Prepared jointly by the society and representatives of the *American Electroplaters' Society* on Committee B-8, the specifications and test methods have been based on the results of a number of research projects and on a series of atmospheric and other exposure tests. Included in the book are the latest recommended practices for preparing zinc, steel, aluminum, copper, and stainless steel for plating. For purchasers of plated products as well as platers who must conform to specifications, which requires access to information on how to perform the tests, this compilation is the only source which will answer practically all requirements.

Symposium on Porcelain Enamels and Ceramic Coatings as Engineering Materials

Published by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. 1954. Price $2.50. Paper cover. 122 pages.

At the 1953 annual meeting of the Society, Committee C-22 on Porcelain Enamel sponsored a symposium on the subject covered by the title of this book, at which sixteen papers drew

attention to a number of important but diversified fields in which such coatings are particularly adapted. These sixteen papers make up a volume which would be of interest to the engineer rather than to the practical metal finisher.

Materials and Processes

By James F. Young. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Second Edition 1954. Price $8.50. 1,074 pages, including index.

One of a series written in the interest of the General Electric Company's Engineering Educational Programs, this edition has been expanded by 50% over the first edition and has been brought up to date in the fields of physical metallurgy and chemistry. It comprises both a textbook and a reference book, dealing with the application of engineering fundamentals of materials and processes to the design, production and control of products. Written for the engineer, each chapter is complete in itself and profusely illustrated. Naturally, covering such an extensive field, too much attention cannot be given to any one subject, so that the metal finisher might consider the section on his specialty rather skimpy. However, he will broaden his understanding of other fabrication processes and the materials employed, as a result of studying the other sections.

Flow and Fan

By C. Harold Berry. Published by The Industrial Press, 148 Lafayette St., New York 13, N. Y. 1954. Price $4.00. 226 pages including index.

This book is based on the author's lecture notes compiled for a course offered at Harvard University and covers the principles of moving air through ducts. It can be considered both a text for engineers who are interested in exhaust and ventilation, and a ready reference for those occasions when the practical problem arises of selecting a suitable fan or system for a given duty.

Although this is a rather technical subject, the presentation is neither overly involved nor over-simplified. Certain portions of the text are at an elementary level for those who need an introduction to the subject, other portions are suitable for the most advanced reader.

Manufacturers' Literature

Batch Cleaning Machines

Magnus Chemical Co., Inc., Equipment Div., Dept. MF, Garwood, N. J.

New 8-page bulletin, 704-AL, "Metal Part Batch Cleaning In Minutes" describing the Magnus Aja-Lif cleaning machines, just released by the Equipment Division of the company, will be of interest to all who are seeking modern and economical cleaning methods to reduce cleaning time and costs.

This new bulletin elaborates on the importance of mechanical agitation in parts cleaning and fully describes the outstanding features of the machines with many photographs of their applications.

Data Sheet on High Vacuum Pumps

Consolidated Vacuum Corp., Dept. MF, Rochester 3, N. Y.

Data Sheet No. 6-55, recently released by the company, contains com-

plete physical dimensions, operating data, and performance curves for each of the type MCF high vacuum oil diffusion pumps. The smallest of the eight fractionating metal pumps in this series has a 2″ diameter and a peak speed of 60 liters per second; the largest has a 32″ diameter and a peak speed of 19,000 liters/second. These pumps will produce an ultimate pressure of 5×10^{-7} mm. Hg. at 25°C.

Heat Transfer Equipment Bulletin

The Industrial Filter & Pump Mfg. Co., Dept. MF, 5900 Ogden Ave., Chicago 50, Ill.

The above manufacturer has issued a new eight-page bulletin on heat exchangers. Industrial heat transfer equipment is tailored to meet individual performance specifications in the heating or cooling of corrosive or noncorrosive liquids and gases. The bulletin illustrates different types and unit combinations of Industrial heat exchangers.

Precious Metals

Auromet Corp., Dept. MF, 199 Canal St., New York 13, N. Y.

The above firm has announced a new folder describing its products. In this folder the following are described:

Bright gold, gold salts & concentrates, antique gold, silver salts, platinum, palladium & rhodium concentrates.

DC Electrical Equipment

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

A complete line of DC electrical equipment for use in electroplating processes is pictured and described in a new bulletin, DC 100. The line includes DC generators, rectifiers, PR controllers, tank rheostats and special panels.

An unusual feature of this bulletin is that both generators and rectifiers are covered, and their respective characteristics listed side by side. Both items are completely dependable sources of direct current for electroplating and allied processes. Two pages in this four-page, two-color bulletin are devoted to the generators and rectifiers.

Information is given for the generators on standard voltage ratings, special construction of the brushes and holders, design of shunts, type of sleeve bearings and construction of the generator ring. Included in the section on rectifiers is a description of 12 special design features of the H-VW-M rectifier.

The section on the PR controllers lists the four types of controllers available. Ratings for the tank rheostats are given and features described in the section on rheostats. Besides giving information on the types of panels available, the special-panels section includes a list of standard equipment and instruments that may be put into

the special panels. Photos are included for all equipment covered in the bulletin.

Self-Operated Flow Regulator

Fischer & Porter Co., Dept. MF, 49 Jacksonville Road, Hatboro, Pa.

A new self-contained flow regulating device for clean gas-free liquids is described and illustrated in the company's Catalog #10-F-70 (four pages). A constant flow rate is maintained by means of energy derived from the flow stream itself, without external power supply. The regulator is unaffected by position and may be equipped with a diaphragm motor valve for remote setting of control point.

Heat Exchangers

Niagara Blower Co., Dept. MF, 405 Lexington Ave., New York 17, N. Y.

Bulletin No. 120 describes the operation of the Niagara Aero heat exchangers used in cooling or controlling of temperatures of industrial liquids. It shows the operation of this equipment by means of diagrams and examples of application by installation photographs.

Acid Proof Cement

The Robinson Clay Product Co., Dept. MF, 65 W. State St., Akron 9, Ohio.

A new, revised bulletin containing a full description of the product and instructions for application of Staminite Acid-Proof Cement is now available. Attractively illustrated and printed in two colors, this four-page bulletin gives detailed information on mixing, as well as all other necessary application data. The chemically setting cement does not depend upon acid washes to become acid proof. Nor does it depend on air to become hard. When it sets chemically it becomes acid proof and waterproof. It is an ideal acid-proof cement when used as jointing material in acid resistant ceramic products construction, such as acid proof brick, tile and vitrified pipe lines.

Materials Handling Equipment

Palmer-Shile Company, Dept. MF, 16035 Fullerton, Detroit 27, Mich.

A new 48-page catalog, largest in company history, is announced by the above designers and manufacturers of materials handling equipment.

Several new products are described in the catalog, including steel boxes with lap joints and a new type nesting stacking box. Another new item offered is a skid box with a side door which provides easy access to materials without removing stacked boxes.

Resinous Bonding Cement for Brick and Tile

The Ceilcote Co., Dept. MF, 4844 Ridge Road, Cleveland, O.

The above company announces the availability of a new 4-page illustrated catalog entitled "Corobond. . . An Improved Bonding Cement for Brick and Tile." It is packed with technical as well as general information on this new acid-proof, alkali-proof and sol-

vent-proof synthetic resinous bonding cement which adds years to the life of brick and tile structures.

Of particular interest is the section describing the manner in which the cement sets. Special additives automatically adjust the speed of initial set to any temperature between 50 and 100°F. In addition to chemicals providing long pot life, it contains a mixture of acid hardeners that work on a delayed reaction principle. While initial hardening is relatively slow, it is fast enough to permit continuous laying-up without extrusion from the bottom courses of the wall. Once started, the final cure proceeds rapidly, and the structure is ready for use within a short time.

The catalog contains a chemical resistance chart to serve as a guide to chemical applications. The ability of this resin cement to withstand acids, alkalies, solvents, hot water and live steam makes it suitable for a wide range of such uses.

Complete directions for using the cement are presented. In addition to proportions, curing time, storage and cleaning of equipment, working time at various temperatures is covered.

Blast Cleaning Accessories

Pangborn Corp., Dept. MF, Hagerstown, Md.

Bulletin 300C, a 28-page booklet, describes the accessories and supplies which are available for use with the company's blast cleaning equipment.

In order to be helpful to customers the book includes engineering selection data as well as specifications. Accessories include: helmets, gloves, hoses, nozzles, aprons, blast room accessories and repair parts. Several pages are devoted to correct selection of abrasives according to cleaning requirements.

Dust Control

Aget-Detroit Co., Dept. MF, Ann Arbor, Mich.

Simplified dust control system for collecting three different kinds of dusts in a small shop is the subject of Bulletin 640, No. 2, issued and available without charge from the above company.

The bulletin illustrates installation and relates how (a) emery dust, (b) dust from a rough grinding operation, (c) lint from a buffer are controlled by a standard Dustkop dust collector which was obtained from stock and installed by the shop's maintenance man.

Plating of Gravure Cylinders

Hanson-Van Winkle-Munning Co., Dept. MF, Matawan, N. J.

Modern procedures and techniques for electroplating rotogravure cylinders are described in a new bulletin, R 100. The bulletin, which includes a dozen photographs, also describes and illustrates some of the latest developments in gravure plating equipment.

This two-color, four-page bulletin, with a two-page insert, lists step-by-step the cycle for plating gravure cylinders with the Ballard process. It also gives three refinements of that cycle: 1) steel cylinder & base cyanide copper plating. 2) acid copper plating over base cyanide copper & acid copper plate. 3) chromium plating over acid copper plate.

Pictured in the bulletin are a single-position, vertical electro-cleaning tank; single-position, vertical processing tanks for both copper and chromium plating; a two-position, vertical processing tank; three types of horizontal processing tanks for copper plating; a preparation tank for copper-plating, and a chromium plating installation. Also pictured and described are the generator and rectifier used in gravure plating operations.

The two-page insert describes and discusses the rotogravure printing process. The section notes the uses and advantages of rotogravure print-

ing, and shows how the process works. It lists information that the plater would want to pass on to the manufacturer when asking for recommendations for plating equipment and supplies.

pH Control in Industry

Beckman Instruments, Inc., Dept. MF, South Pasadena 1, Cal.

An informative report on the role of automatic pH control in industry to help executives, process engineers and chemists better understand this important technique, has just been released.

The 12-page brochure, Bulletin 340-9, gives a picture of continuous pH recording and control in three major processing areas — water treatment, control of chemical reactions, and waste disposal. Simplified diagrams and sketches describe typical pH installations for a variety of processes, with emphasis on improved product quality, better process efficiency and lower material and maintenance costs.

A separate section on chemical reactions explains pH control in emulsification, electrolysis, neutralization, hydrolysis, coagulation and precipitation.

Metal Plate Industrial Flooring

Flash-Stone Co., Inc., Dept. MF, 3723 Pulaski Ave., Philadelphia 40, Pa.

A fully-illustrated 16-page catalog describes Ancor rolled steel flooring plates and their uses in armoring heavy-duty industrial concrete floors. The design characteristics which prevent buckling, curling, or cracking, and eliminate slipperiness and noise are fully described and illustrated.

In-use photographs show floors, consisting of these plates permanently interlocked in a 1-½" concrete imbedment layer, at work in heavy industrial environments. Another series of photographs illustrates installation procedure to obtain optimum service from these floors and to prevent the disadvantages of conventional steel flooring.

Neoprene Sprayed Coatings and Sheet Linings

MW Protective Coatings Div., Metalweld, Inc., Dept. MF, Philadelphia 29, Pa.

The company has issued a bulletin outlining the protective qualities of Neoprene in applications affected by sunlight, heat, abrasion, oil, cold and various chemicals. Included in the bulletin is a table on organic chemicals for which Neoprene lined tanks and piping can be recommended.

Corrosion Preventives

Rust-Oleum Corp., Dept. MF, 2799 Oakton St., Evanston, Ill.

Just released by the company, a leading manufacturer of rust preventives for over 25 years, the new 1954 general catalog provides an outstanding treatise on rust prevention and is dedicated to showing all industry how to stop rust.

The new, enlarged catalog features 94 color chips of company products and includes complete instructions for surface preparation and application of primers, short oil type, long oil type, machinery and implement finishes, chemical and heat resistant types,

sealers, thinning oils, and floor and masonry coatings.

In addition, two pages of the new catalog are devoted to questions and answers. Thus, full and clear explanations are given on all problems relating to the surface preparation and applications of the firm's products.

Tank Linings

Chase Chemical Corp., Dept. MF, 3527 Smallman St., Pittsburgh 1, Pa.

The above firm has issued a new, illustrated folder on its protective linings and coatings to protect many types of industrial steel equipment from abrasion and corrosion. Brief descriptions of each are given.

The folder is available on request at the above address.

Protective Aluminum Paint

Emjay Maintenance Engineers, Dept. MF, 327 Union Ave., Rutherford, N. J.

A new bulletin offered by the company includes a reprinted case history of a three-year service application test to which Kolmetal coatings were subjected. This new product, consisting of pulverized aluminum in a plastic base, is applied without heat to equipment and storage tanks used by the chemical industries. The bulletin covers characteristics and applications, and also includes a table of recommended uses and application instructions.

OBITUARY

PIERRE SAMUEL DU PONT

Pierre Samuel du Pont, industrialist, philanthropist and head of the du Pont family, died unexpectedly on the night of April 5th in Memorial hospital, Wilmington, Del., at the age of 84. He was stricken at his home, near Kennett Square, Pa., about 7 p.m., and died three hours later.

Only the week before Mr. du Pont, with his nephews and nieces and members of his own generation beaming approval, was made a commander of the Legion of Honor of France. He had been a chevalier since soon after World War I in recognition of the company's contributions to the Allied cause and later was honored with the rank of officer.

Pierre S. du Pont acquired E. I. du Pont de Nemours & Co. at the turn of the century with his two cousins, Alfred I. and T. Coleman du Pont. They began the transformation of the company, already 100 years old, from a maker of black powder to the greatest chemical enterprise in the world, with more than 90,000 employees and 145,000 stockholders. Pierre du Pont was a director and honorary chairman of the board of the company at his death.

A direct descendant and namesake of Pierre Samuel du Pont de Nemours, one of the leading moderate reformers of France before and during the Revolution, Mr. du Pont was born January 15, 1870, near the site of the first Du Pont powder mills, built in 1802 on the Brandywine Creek, near Wilmington, by his great grandfather, Eleuthere Irenee du Pont. His father, Lammot du Pont, was a noted inventor and authority on explosives, who founded one of the country's first important dynamite plants.

Left fatherless at fourteen by an explosion of nitroglycerin at the Repauno, N. J., plant, Pierre du Pont was the eldest son, one of eleven brothers and sisters. Two of his

brothers, Irenee and Lammot, followed him into the presidency of Du Pont.

Mr. du Pont was educated at The William Penn Charter School in Philadelphia and at the Massachusetts Institute of Technology, from which he was graduated in 1890 and went to work in the family powder mills. From 1892 to 1899 he was assistant superintendent of the Carney's Point, N. J., plant, where he collaborated with Francis G. du Pont in developing the first successful Du Pont smokeless powder. The two patented the formula for smokeless shotgun powder.

In 1899, Mr. du Pont left the family business and moved to Lorain, Ohio, where he undertook the management of various properties in association with Tom L. Johnson, later reform mayor of Cleveland. He became president of the Johnson Company, former owner of the Lorain Steel Company, now a part of the United States Steel Corporation. It was during this period that he employed, as a stenographer, John J. Raskob, who later became a confidant and associate.

In 1902, Pierre du Pont joined his cousins, T. Coleman du Pont and Alfred I. du Pont, in purchasing the century-old family powder business, which was about to pass into the hands of others. They formed a new corporation, E. I. du Pont de Nemours Co., of Delaware, forerunner of the present company. Mr. du Pont first served as treasurer, later as vice-president and acting president.

In 1915, Coleman du Pont offered to sell his Du Pont stock. A group led by Pierre du Pont purchased the shares, forming Christiana Securities Company. Pierre du Pont was elected president of Christiana and held that position until May, 1950, when he was succeeded by his brother, Lammot.

Coleman du Pont resigned as president of the Du Pont Company and in 1915, Pierre du Pont succeeded him, becoming also chairman of the finance committee.

Mr. du Pont resigned as president on May 1, 1919, being succeeded by Irenee du Pont. On that date he became chairman of the board of directors and, until 1926, continued as chairman of the finance committee. He resigned as chairman of the board in May, 1940, remaining as a director and member of the finance committee.

He was a member of President Hoover's National Committee on Unemployment to mobilize relief resources in 1931 and, two years later, under President Roosevelt, was a member of the Industrial Advisory Board of the N.R.A. as well as a member of the National Labor Board.

Mr. du Pont was a life member of the Massachusetts Institute of Technology Corporation. In 1932 Lafayette College and the University of Delaware awarded him honorary degrees. In 1935 Wilmington named in his honor its newest high school.

He was married October 6, 1915, to Alice Belin, of Scranton, Pa., a cousin. She died on June 23, 1944.

For a man of his position, Mr. du Pont belonged to few clubs and was a director of only three companies — Du Pont, Christiana Securities, and the Wilmington Trust Company. For many years he was also a director of the Pennsylvania Railroad.

He was a member of the Franklin Institute, the American Academy of Political Science, the American Philosophical Society, The American Chemical Society, the American Association for the Advancement of Science, the Society of Automotive Engineers.

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Yearly (12 times)	8.00

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1—5000/2500 Amp., 8/16 V., Electric Prod., 25° C., Synch., Exc.-in-head.

1—5000/2500 Amp., 9/18 V., Columbia.

1—5000/2500 Amp., 8/16 V., Chandeysson, 25° C., Exc.-in-head.

1—5000/2500 Amp., 6/12 V., Chandeysson, 25° C., Synch., Exc.-in-head.

1—4000/2000 Amp., 6/12 V., Chandeysson, 25° C., Exc.-in-head.

1—3000/1500 Amp., 6/12 V., Columbia, Synch.

1—2500/1250 Amp., 9/18 V., Electric Prod., Synch., Exc.-in-head.

1—2000/1000 Amp., 8/16 V., Electric Prod.

1—1500/750 Amp., 6/12 V., H-VW-M, Synch., Exc.-in-head.

1—1500/750 Amp., 12/24 V., Chandeysson, Synch., Exc-in-head.

1—1000/500 Amp., 6/12 V., Electric Prod.

— ANODIZERS —

1—400 Amp., 40 V., Chandeysson, Exc.-in-head.

1—1000 Amp., 30 V., Ideal, Exc.-in-head.

1—1000 Amp., 40 V., Chandeysson, 25°C.

1—750 Amp., 60 V., H-VW-M, Synch., Exc.-in-head.

1—500 Amp., 25 V., Chandeysson, Synch., Exc.-in-head.

1—400 Amp., 40 V., M. G. C., Exc.-in-head.

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1—#200 Ronci Lacquer Machine.

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